

## 4.0 Organochlorine Pesticides

The current chapter described the human health and ecological risk screening criteria organochlorine pesticides and a number of internet sources of additional information. Observed levels of organochlorine pesticides<sup>43</sup> in Connecticut River fish were compared with human health and ecological screening benchmarks by Reach. DDT breakdown products were statistically compared between Reaches. DDT and related breakdown products from chemical, physical and biological weathering, pose a risk to human subsistence fishers and to fish-eating birds, but not to recreational fishers or fish-eating mammals.

### 4.1 Ecological and Human Health Risk Screening Criteria for Organochlorine Pesticides

Human health screening benchmarks for carcinogenic and non-carcinogenic endpoints for recreational and subsistence fishers were obtained from USEPA (2000b)(Table 43). A risk level of  $10^{-5}$  was used for carcinogenic endpoint screening<sup>44</sup>.

Ecological screening benchmarks (NOAELs<sup>45</sup>) were obtained for belted kingfisher and river otter from Sample and others (1996)(Table 44). These two riverine species were chosen as representative of higher trophic level species that derive large proportions of their diet from fish.

(Sample and others 1996) observes that,

“(Eco-toxicological) [S]creening assessments serve to identify those contaminants whose concentrations are sufficiently high such that they may be hazardous to wildlife. The primary emphasis of a screening assessment is to include all potential hazards while eliminating clearly insignificant hazards. To prevent any potential hazards from being overlooked, assumptions made in a screening assessment are

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<sup>43</sup>EPA's Integrated Risk Information System (IRIS) (<http://www.epa.gov/iris/>) provides toxicological profiles for organochlorine pesticides, PCBs, dioxins/furans, methylmercury and other chemicals. Also, see [http://www.scorecard.org/about/txt/organochlorine\\_pesticides.html](http://www.scorecard.org/about/txt/organochlorine_pesticides.html) and <http://www.epa.gov/pesticides/> for additional information on organochlorine pesticides. USEPA (2002b) provides an excellent non-technical summary of Persistent Organic Pollutants (POPs) from a global perspective: <http://epa.gov/oia/toxics/brochure.html>. An interesting historical account of the substantial banning of DDT by EPA in 1972 is available at: <http://www.epa.gov/history/topics/ddt/index.htm>. The CDC Third National Exposure Report (2005) section on organochlorine pesticides provides a comprehensive discussion of U.S. human exposure to organochlorine pesticides and other contaminants in the current study: [http://www.cdc.gov/exposurereport/3rd/results\\_08.htm](http://www.cdc.gov/exposurereport/3rd/results_08.htm).

<sup>44</sup>A risk level of  $10^{-5}$  corresponds to an estimated increased risk of 1:100,000 of acquiring cancer from a life time's exposure at this level. It is the middle of EPA's acceptable cancer risk range.

<sup>45</sup>No-Observed-Adverse-Effect Level (NOAEL): The highest exposure level at which there are no biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered adverse or precursors of adverse effects (<http://www.epa.gov/iris/gloss8.htm>).

conservative. NOAEL-based benchmarks are used in screening assessments because they are conservative and represent maximum concentrations that are believed to be nonhazardous. Exceedance of a NOAEL-based benchmark does not suggest that adverse effects are likely; it simply indicates contamination is sufficiently high to warrant further investigation.”

**Table 43.** Human Health Screening Levels for Chlorinated Pesticides for Recreational and Subsistence Fishers (USEPA 2000b). Related compounds (homologs) are grouped by color.

Chlorinated Pesticides	Recreational Fishers (ppb)		Subsistence Fishers (ppb)	
	Noncarcinogens	Carcinogens (RL=10 <sup>-5</sup> )	Noncarcinogens	Carcinogens (RL=10 <sup>-5</sup> )
Aldrin	N/A	N/A	N/A	N/A
alpha-BHC	N/A	N/A	N/A	N/A
beta BHC	N/A	N/A	N/A	N/A
delta-BHC	N/A	N/A	N/A	N/A
gamma-BHC	N/A	N/A	N/A	N/A
Total BHC <sup>46</sup> - mixed isomers	N/A	N/A	N/A	N/A
Heptachlor	N/A	N/A	N/A	N/A
Heptachlor Epoxide	52	4.39	6.39	.540
Hexachlorobenzene	3,200	25.0	393	3.07
Oxychlordane	see total	see total	see total	see total
cis-Nonachlor	see total	see total	see total	see total
trans-Nonachlor	see total	see total	see total	see total
alpha-Chlordane	see total	see total	see total	see total
gamma-Chlordane	see total	see total	see total	see total
Total Chlordane <sup>47</sup>	2,000	114	245	14

<sup>46</sup>A synonym for BHC is HCH.

<sup>47</sup>Total Chlordane includes cis and trans-nonachlor and alpha and gamma chlordane.

Chlorinated Pesticides	Recreational Fishers (ppb)		Subsistence Fishers (ppb)	
	Noncarcinogens	Carcinogens (RL=10 <sup>-5</sup> )	Noncarcinogens	Carcinogens (RL=10 <sup>-5</sup> )
Endosulfan I	see total	see total	see total	see total
Endosulfan II	see total	see total	see total	see total
Endosulfan Sulfate	see total	see total	see total	see total
Total Endosulfan	24,000	N/A	2,949	N/A
o,p'-DDT	see total	see total	see total	see total
p,p'-DDT	see total	see total	see total	see total
p,p'-DDE	see total	see total	see total	see total
o,p'-DDE	see total	see total	see total	see total
o,p'-DDD	see total	see total	see total	see total
p,p'-DDD	see total	see total	see total	see total
Total DDT Homologs <sup>48</sup>	2,000	117	245	14.4
Dieldrin	200	2.5	24	.307
Endrin	1,200	N/A	147	N/A
Endrin Aldehyde	N/A	N/A	N/A	N/A
Endrin Ketone	N/A	N/A	N/A	N/A
Methoxychlor	N/A	N/A	N/A	N/A
Mirex	N/A	N/A	N/A	N/A

Note: N/A - Value not Available

<sup>48</sup> In this study total DDT homologs (chemical forms of the parent DDT compound resulting from biological and chemical 'weathering') are the sum of the six homologs (o,p'-DDT, p,p'-DDT, p,p'-DDE, o,p'-DDE, o,p'-DDD, and p,p'-DDD). Some DDT homologs are more resistant to 'weathering' than others. Organochlorine compounds, including pesticides, degrade extremely slowly in the environment (e.g. Nash and Woolson 1967). DDD was also used as a pesticide in addition to being a degradate of DDT (Gilliom and others 2006).

**Table 44.** Wildlife Toxicological Benchmarks for Belted Kingfisher and Mink for Chlorinated Pesticides in CT River Fish (Sample and others 1996). Related compounds (homologs) are grouped by color.

Chlorinated Pesticides	Belted Kingfisher	River Otter
	NOAEL (ng/g - ppb)	NOAEL (ng/g - ppb)
Aldrin	N/A	813
alpha-BHC	1,110	70
beta-BHC	1,110	1,630
delta-BHC	1,110	70
gamma-BHC	1,110	70
Total BHC - mixed isomers <sup>49</sup>	1,110	70
Heptachlor	N/A	529
Heptachlor Epoxide	N/A	529
Hexachlorobenzene	N/A	N/A
Oxychlordane	4,200	10,100
cis-Nonachlor	N/A	N/A
trans-Nonachlor	N/A	N/A
alpha-Chlordane	4,200	10,100
gamma-Chlordane	4,200	10,100
Total Chlordane	4,200	10,100
Endosulfan I	19,700	610
Endosulfan II	19,700	610
Endosulfan Sulfate	19,700	610
Total Endosulfan	19,700	610

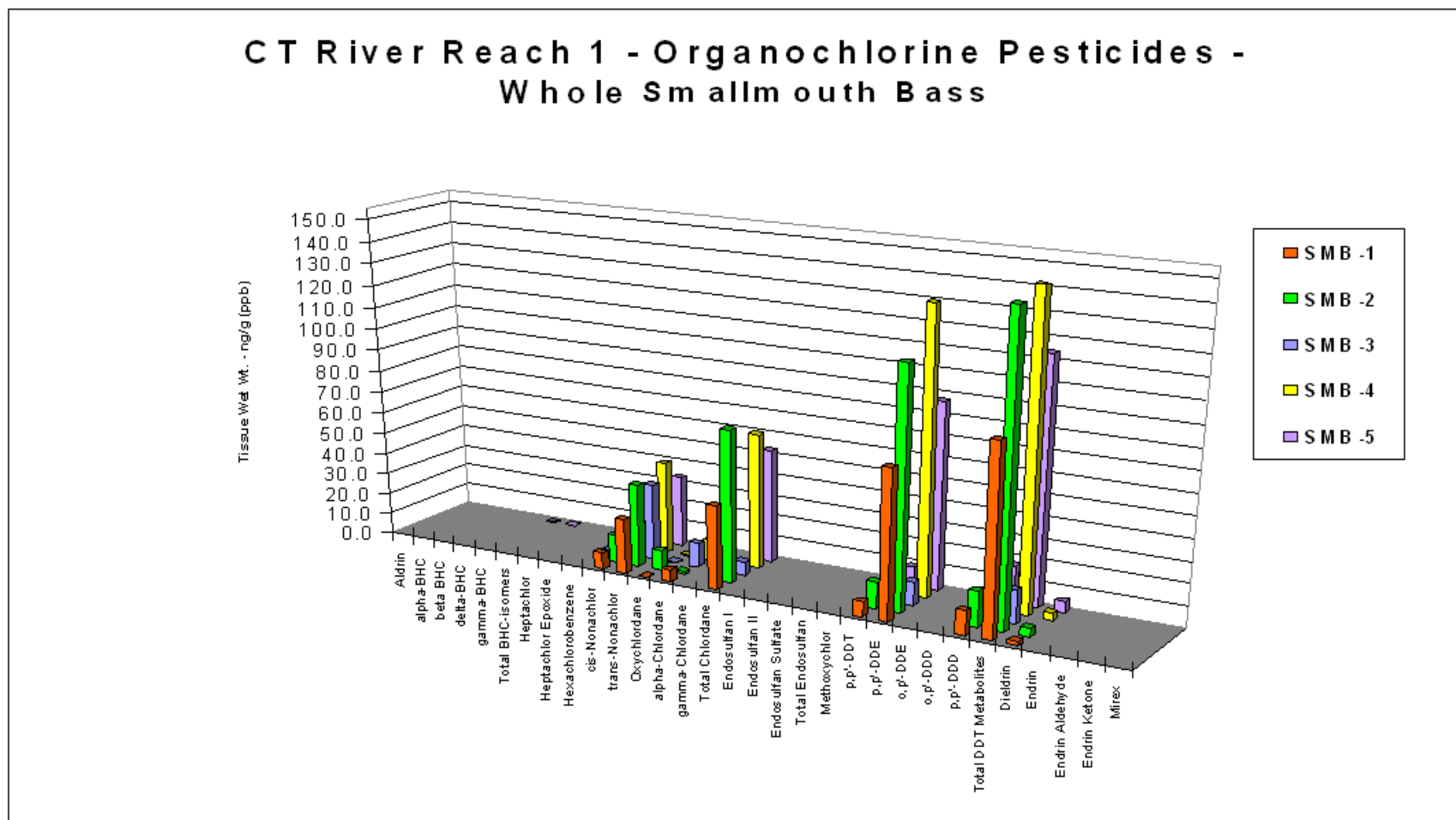
<sup>49</sup>Screening levels for BHC isomers; heptachlor and heptachlor epoxide; alpha, gamma and oxychlordane; endosulfan I, II and endosulfan sulfate; DDT homologs; and endrin, endrin aldehyde and endrin ketone were based on parent compounds as only BHC-mixed isomer, heptachlor, endosulfan, endrin and chlordane screening values are currently available, with the exception of a river otter value for beta-BHC. Homologous forms of BHC, DDT, endosulfan and chlordane were summed. A synonym for BHC is HCH.

Chlorinated Pesticides	Belted Kingfisher	River Otter
	NOAEL (ng/g - ppb)	NOAEL (ng/g - ppb)
<b>o,p'-DDT</b>	6	3,250
<b>p,p'-DDT</b>	6	3,250
<b>o,p'-DDE</b>	6	3,250
<b>p,p'-DDE</b>	6	3,250
<b>o,p'-DDD</b>	6	3,250
<b>p,p'-DDD</b>	6	3,250
<b>Total DDT Homologs</b>	6	3,250
<b>Dieldrin</b>	152	81
<b>Endrin</b>	20	N/A
<b>Endrin Aldehyde</b>	20	N/A
<b>Endrin Ketone</b>	20	N/A
<b>Methoxychlor</b>	N/A	16,300
<b>Mirex</b>	N/A	N/A

Note: N/A - Value not Available

## 4.2 Organochlorine Pesticides in Fillets and Whole Fish by Reach

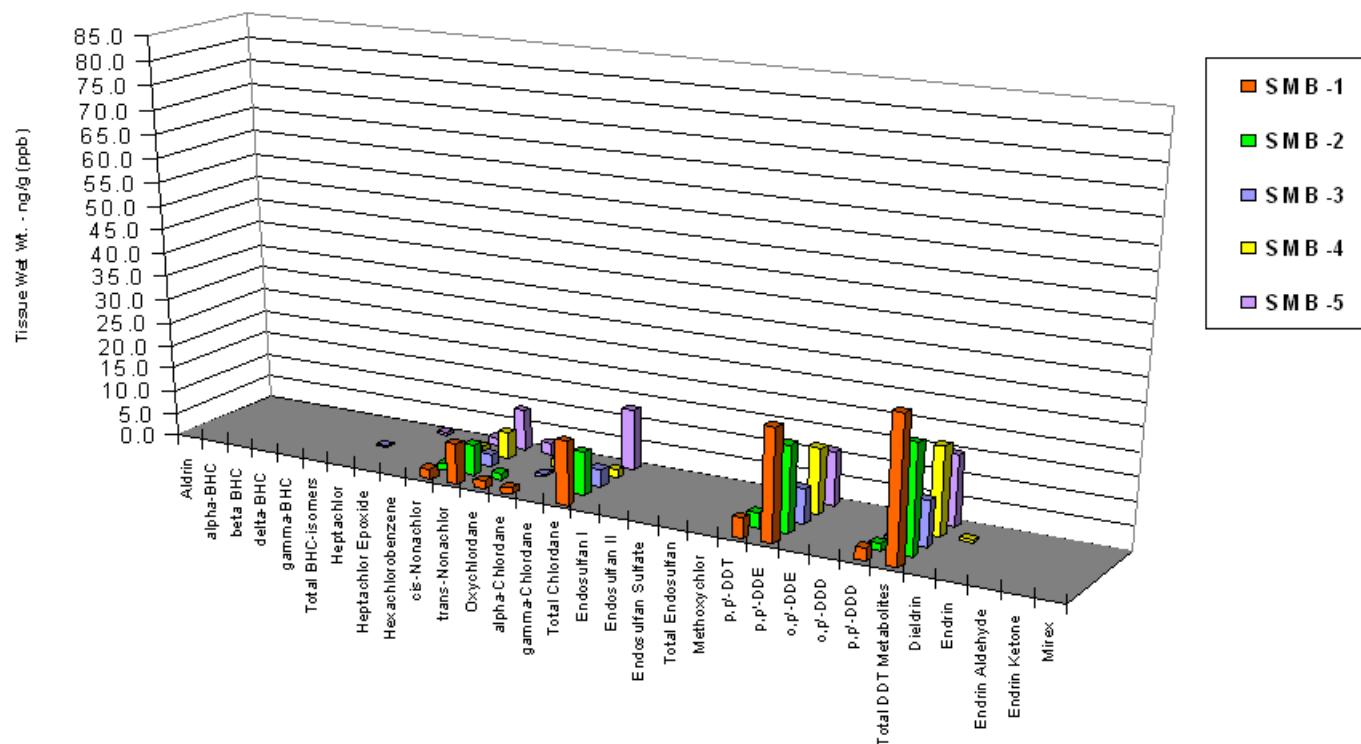
### 4.2.1 Smallmouth Bass Fillets



**Figure 80.** CT River Reach 1 - Organochlorine Pesticides in Whole Smallmouth Bass

In Reach 1 four smallmouth bass (SMB) fillet composites exceeded the carcinogenic SV for subsistence fishers for total DDT homologs (Figure 80). One SMB fillet barely exceeded the subsistence fisher cancer SV for dieldrin.

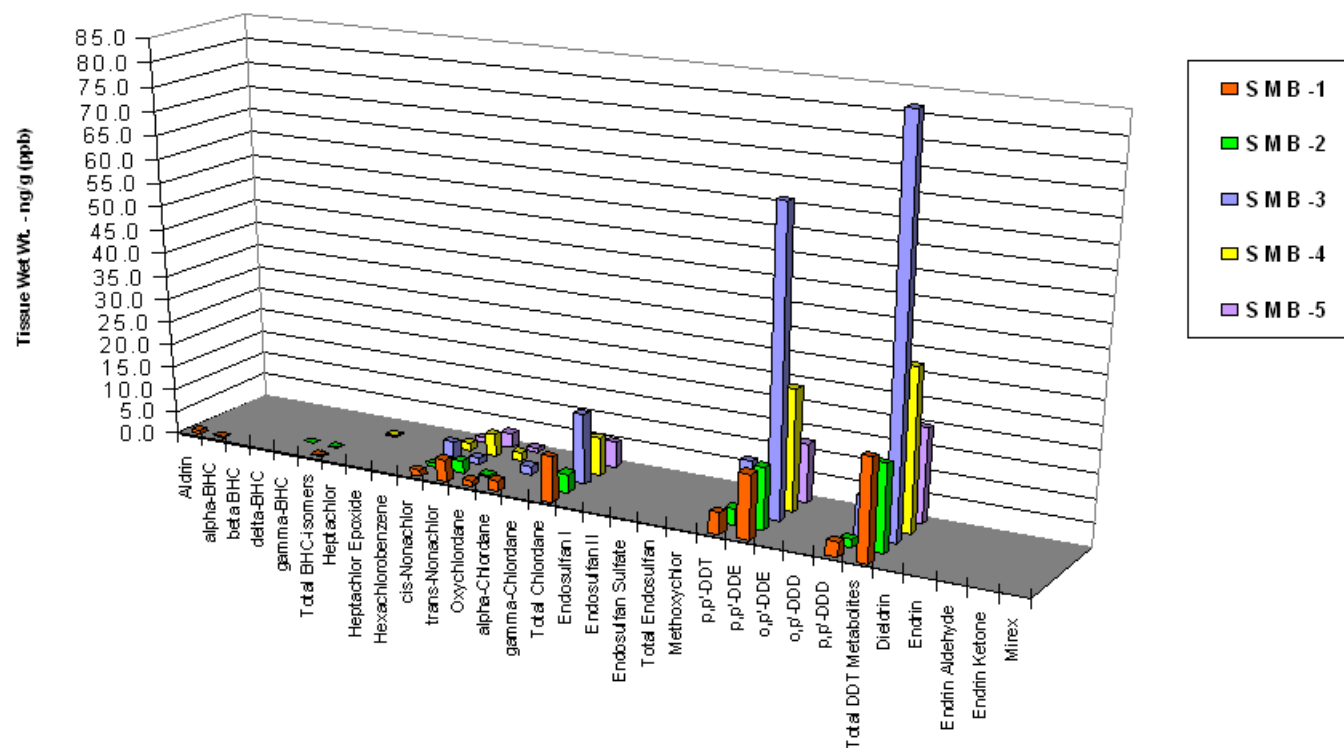
## CT River Reach 2 - Organochlorine Pesticides - Smallmouth Bass Fillets



**Figure 81.** CT River Reach 2 - Organochlorine Pesticides in Smallmouth Bass Fillets

In Reach 2 four SMB fillet composites exceeded the cancer SV for subsistence fisher exposure to total chlordane, p,p'-DDE and total DDT homologs (Figure 81).

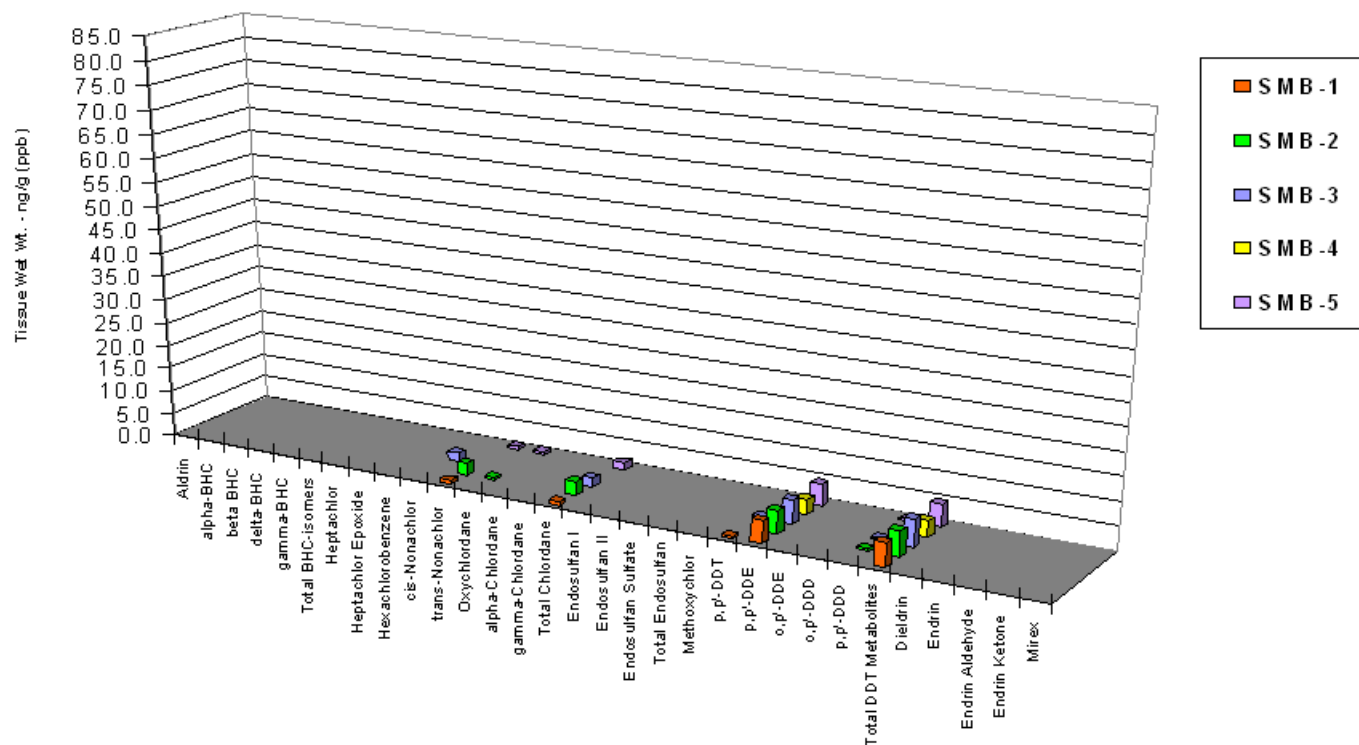
## CT River Reach 3 - Organochlorine Pesticides - Smallmouth Bass Fillets



**Figure 82.** CT River Reach 3 - Organochlorine Pesticides in Smallmouth Bass Fillets

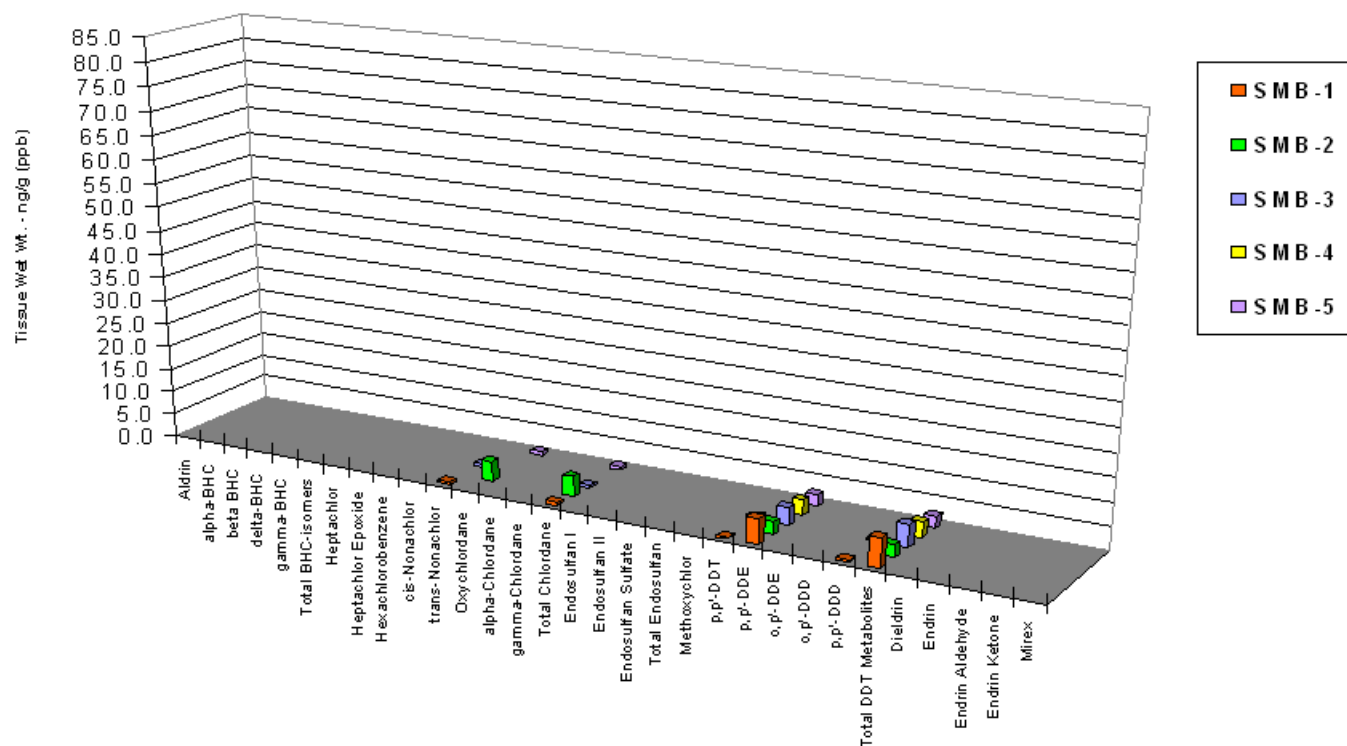
In Reach 3 one SMB fillet composite exceeded the cancer SV for subsistence fisher exposure to total chlordane (Figure 82). All SMB fillets exceeded the cancer SV for subsistence fisher exposure to total DDT homologs.

## CT River Reach 4 - Organochlorine Pesticides - Smallmouth Bass Fillets



**Figure 83.** CT River Reach 4 - Organochlorine Pesticides in Smallmouth Bass Fillets  
No human health SVs were exceeded in SMB fillet composites in Reach 4 (Figure 83).

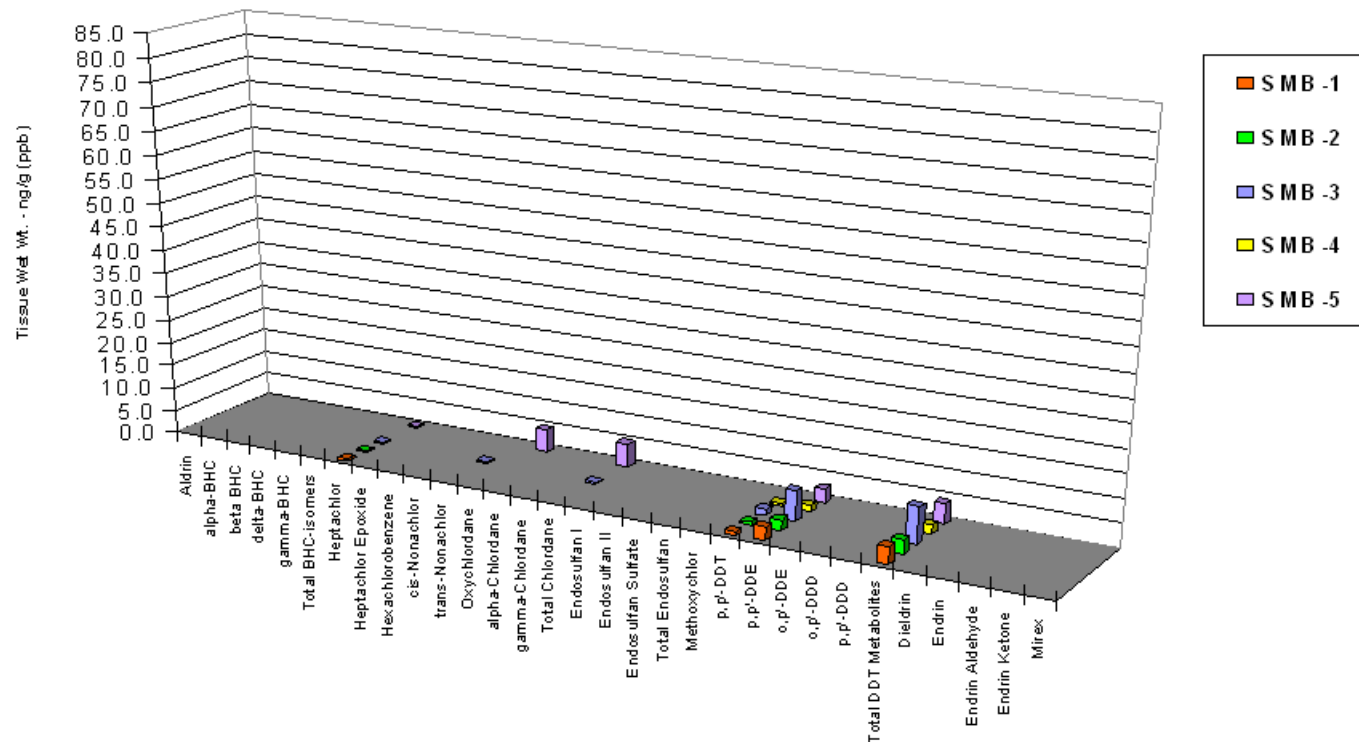
## CT River Reach 5 - Organochlorine Pesticides - Smallmouth Bass Fillets



**Figure 84.** CT River Reach 5 - Organochlorine Pesticides in Smallmouth Bass Fillets

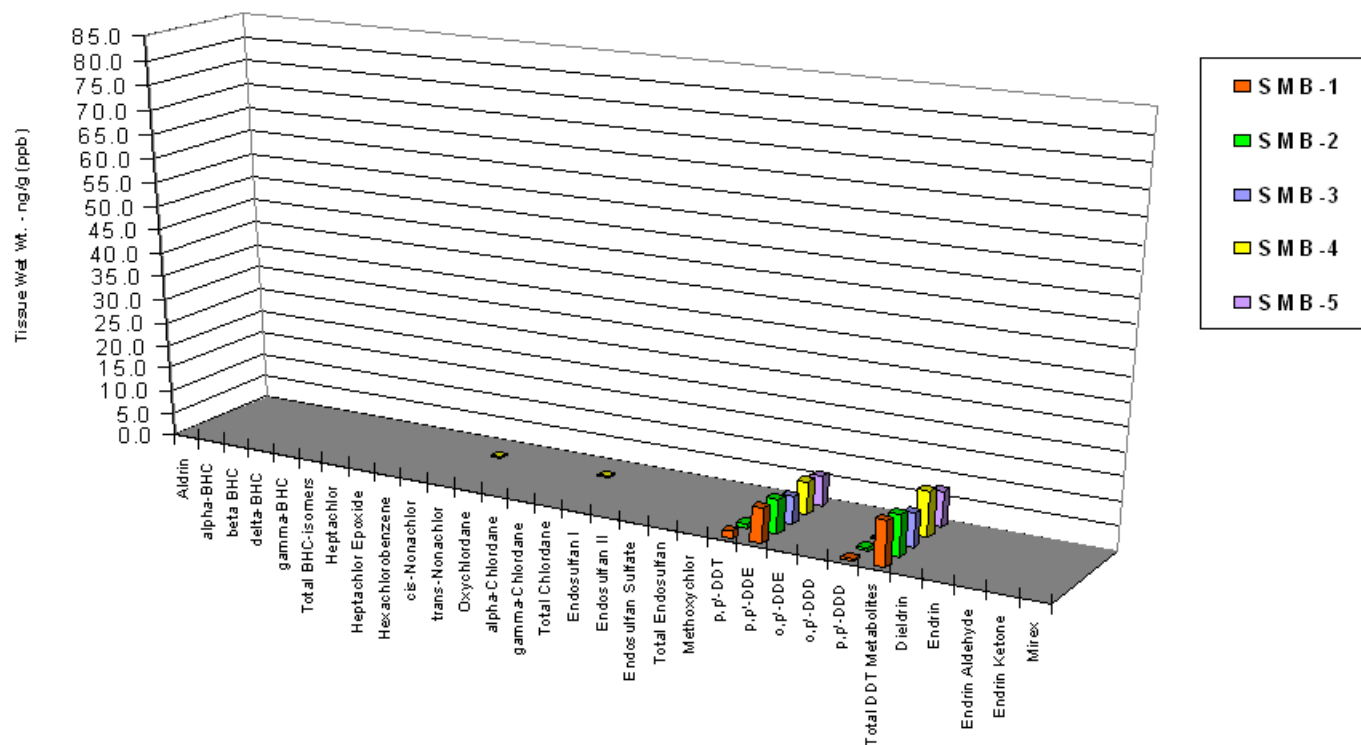
No human health SVs were exceeded in SMB fillet composites in Reach 5 (Figure 84).

## CT River Reach 6 - Organochlorine Pesticides - Smallmouth Bass Fillets



**Figure 85.** CT River Reach 6 - Organochlorine Pesticides in Smallmouth Bass Fillets  
No human health SVs were exceeded in SMB fillet composites in Reach 6 (Figure 85).

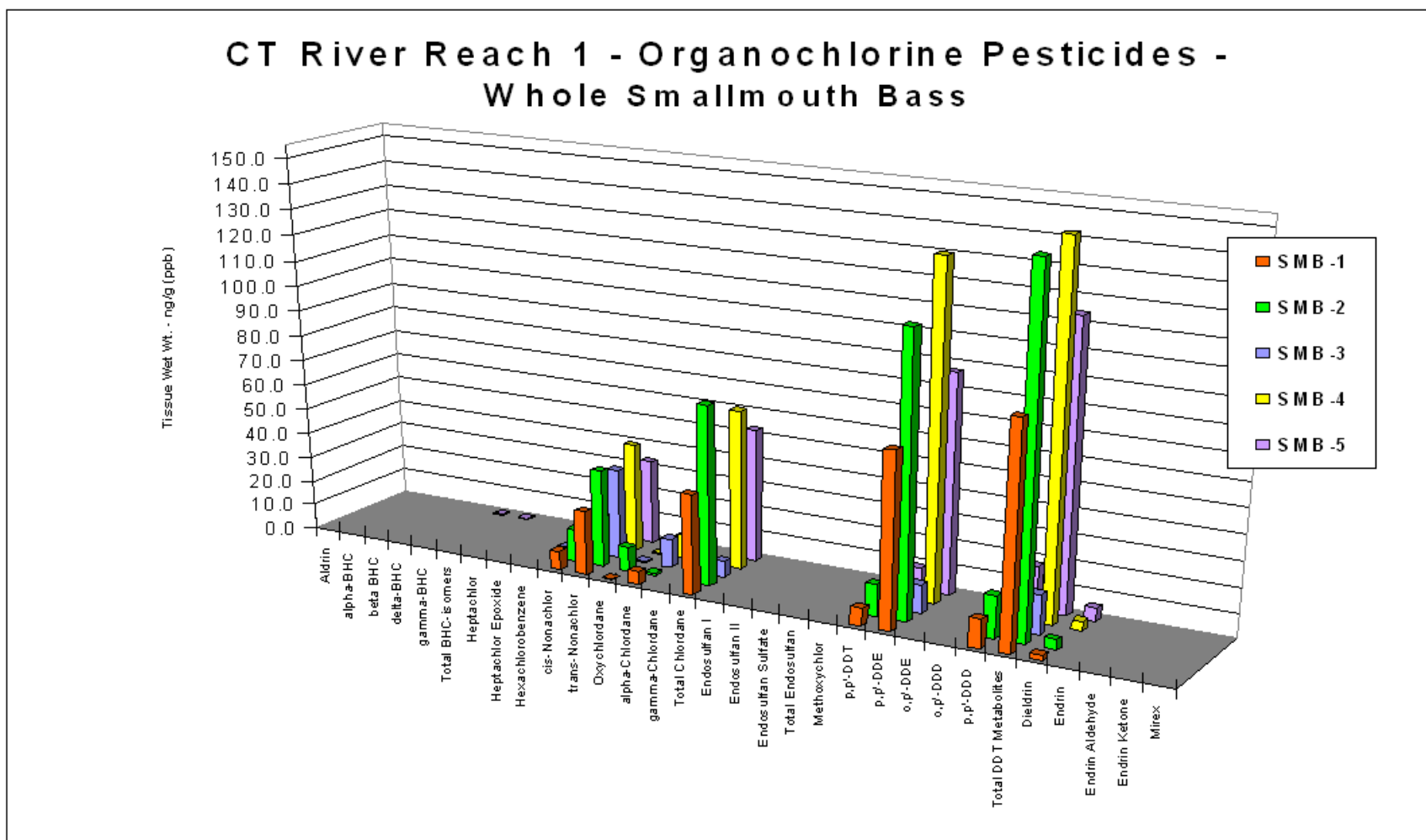
## CT River Reach 7 - Organochlorine Pesticides - Smallmouth Bass Fillets



**Figure 86.** CT River Reach 7 - Organochlorine Pesticides in Smallmouth Bass Fillets

No human health SVs were exceeded in SMB fillet composites in Reach 7 (Figure 86).

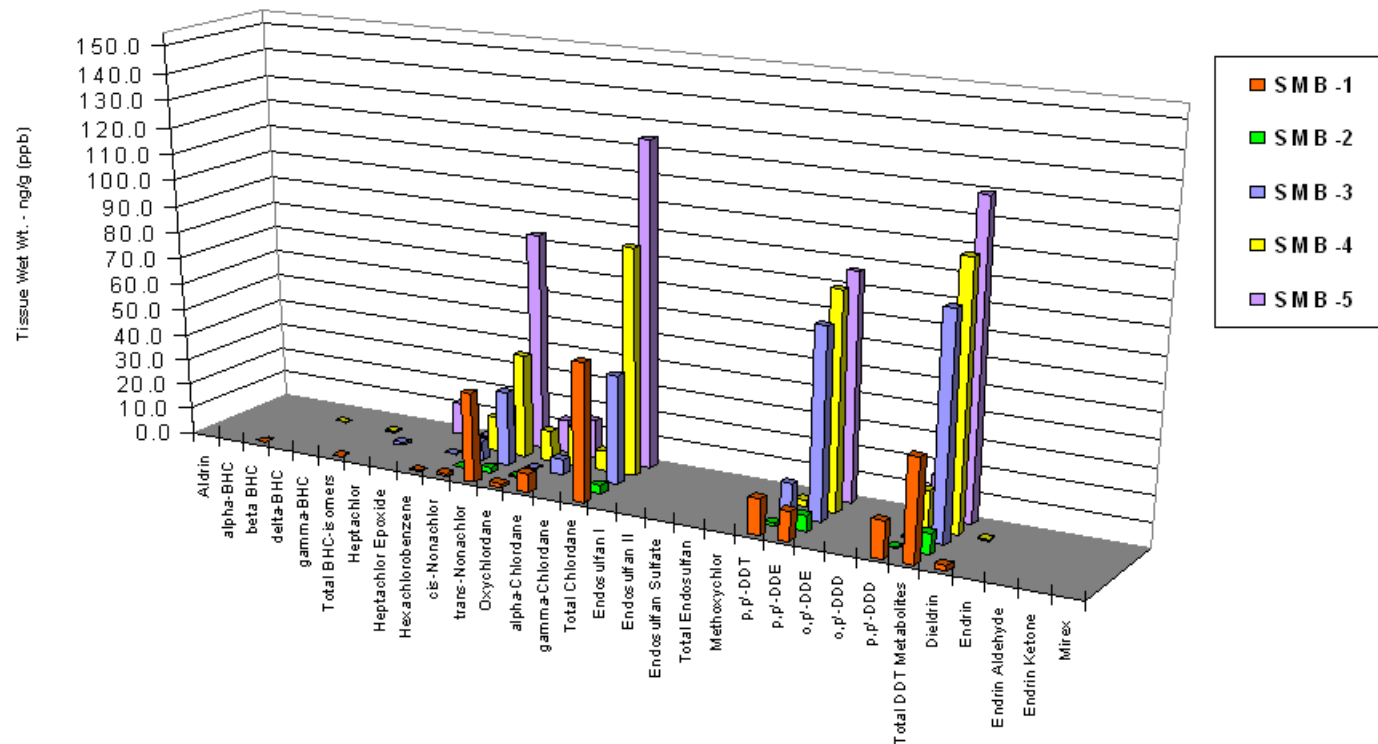
## 4.2.2 Whole Smallmouth Bass



**Figure 87.** CT River Reach 1 - Organochlorine Pesticides in Whole Smallmouth Bass

Four whole SMB composites in Reach 1 exceeded the cancer SV for subsistence fisher exposure to total chlordane in Reach 1 (Figure 87). Four whole SMB exceeded the subsistence fisher cancer SV for exposure to total DDT homologs. Four whole SMB exceeded the cancer SV for subsistence fisher exposure to dieldrin. All whole SMB exceeded the NOAEL for kingfisher exposure to total DDT homologs.

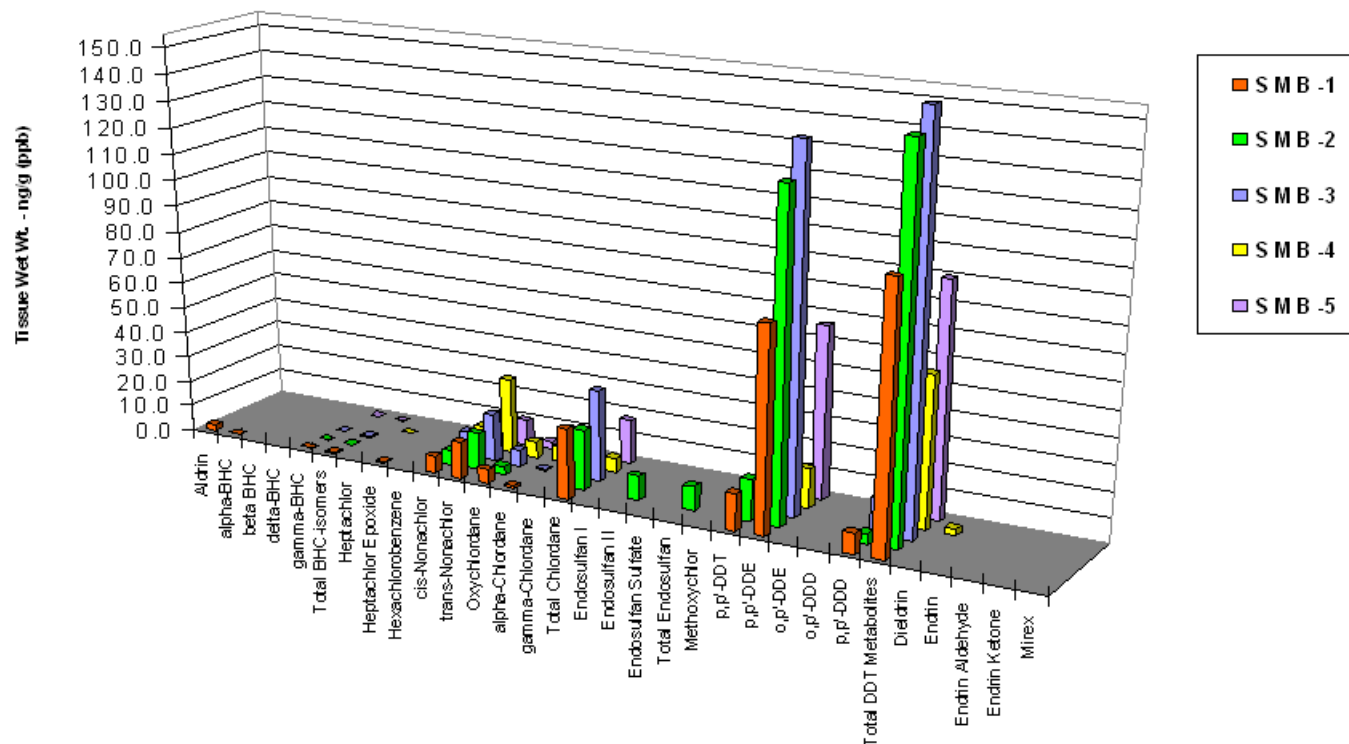
## CT River Reach 2 - Organochlorine Pesticides - Whole Smallmouth Bass



**Figure 88.** CT River Reach 2 - Organochlorine Pesticides in Whole Smallmouth Bass

In Reach 2 four whole SMB composites exceeded the subsistence fisher cancer SV for exposure to total chlordane (Figure 88). Four whole SMB composites exceeded the subsistence fisher cancer SV for exposure to total DDT homologs. All whole SMB exceeded the NOAEL for kingfisher exposure to total DDT homologs.

## CT River Reach 3 - Organochlorine Pesticides - Whole Smallmouth Bass

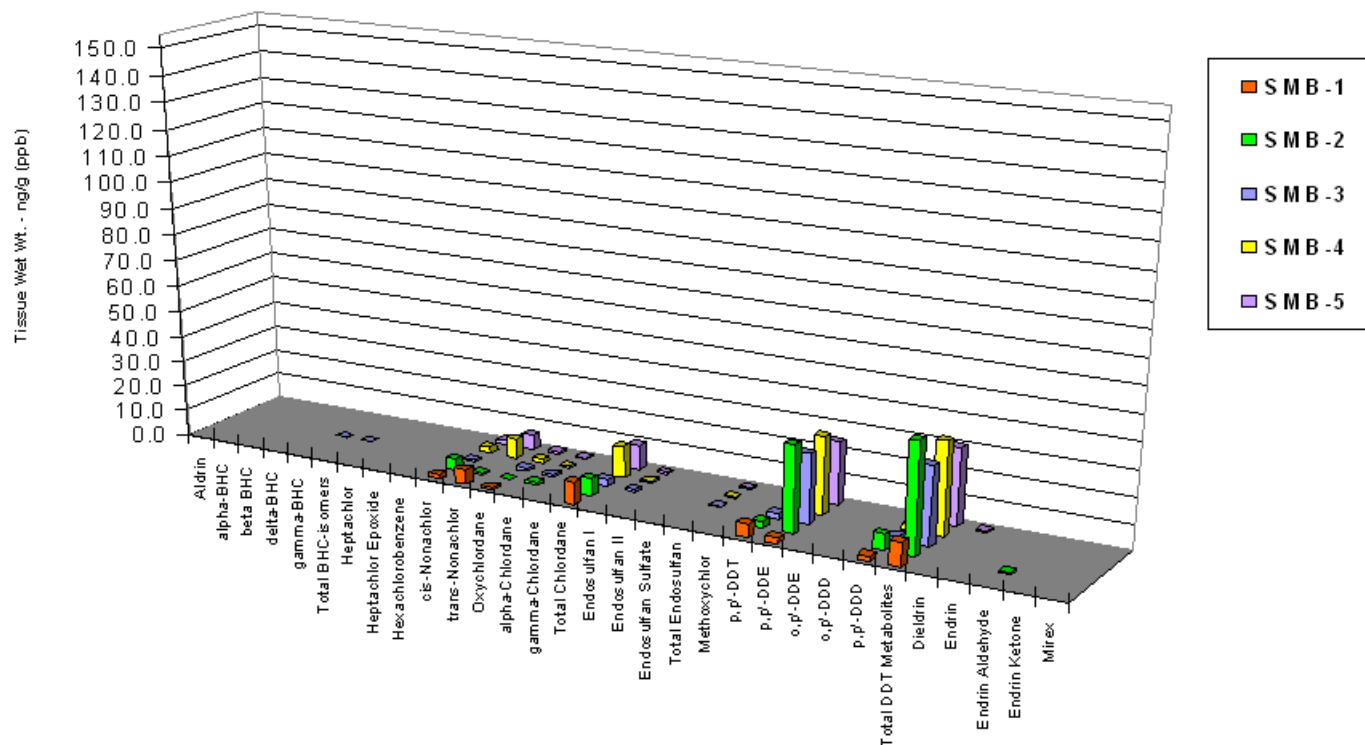


**Figure 89.** CT River Reach 3 - Organochlorine Pesticides in Whole Smallmouth Bass

Four whole SMB composites exceeded the cancer SV for subsistence fisher exposure to total chlordane in Reach 3 (Figure 89). Five whole SMB composites exceeded the subsistence fisher cancer SV for exposure to total DDT homologs. One whole SMB composite exceeded the subsistence fisher cancer SV for exposure to dieldrin. All whole SMB exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

**Connecticut River Fish Tissue Contaminant Study (2000)**

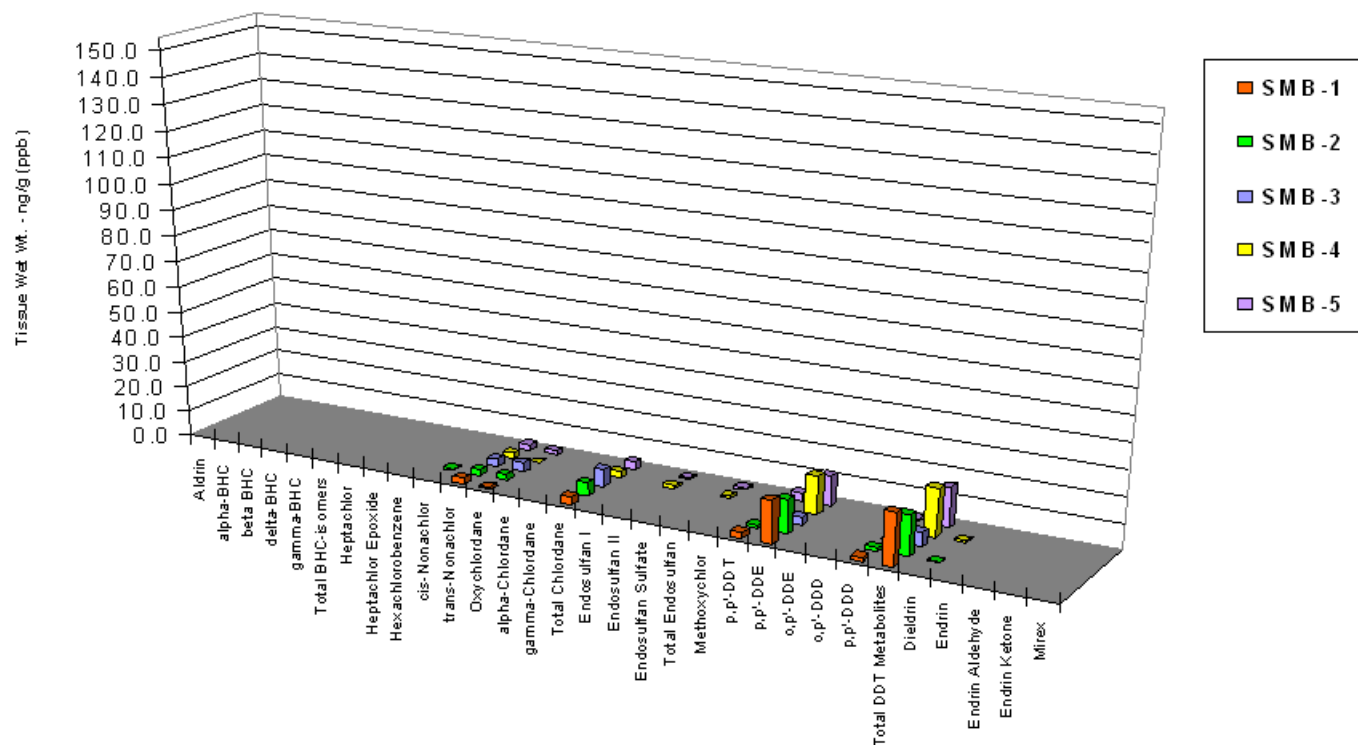
## CT River Reach 4 - Organochlorine Pesticides - Whole Smallmouth Bass



**Figure 90.** CT River Reach 4 - Organochlorine Pesticides in Whole Smallmouth Bass

Four whole SMB composites exceeded the cancer SV for subsistence fisher exposure to total DDT homologs in Reach 4 (Figure 90). The subsistence fisher cancer SV for dieldrin was exceeded in one whole SMB composite. Four whole SMB composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

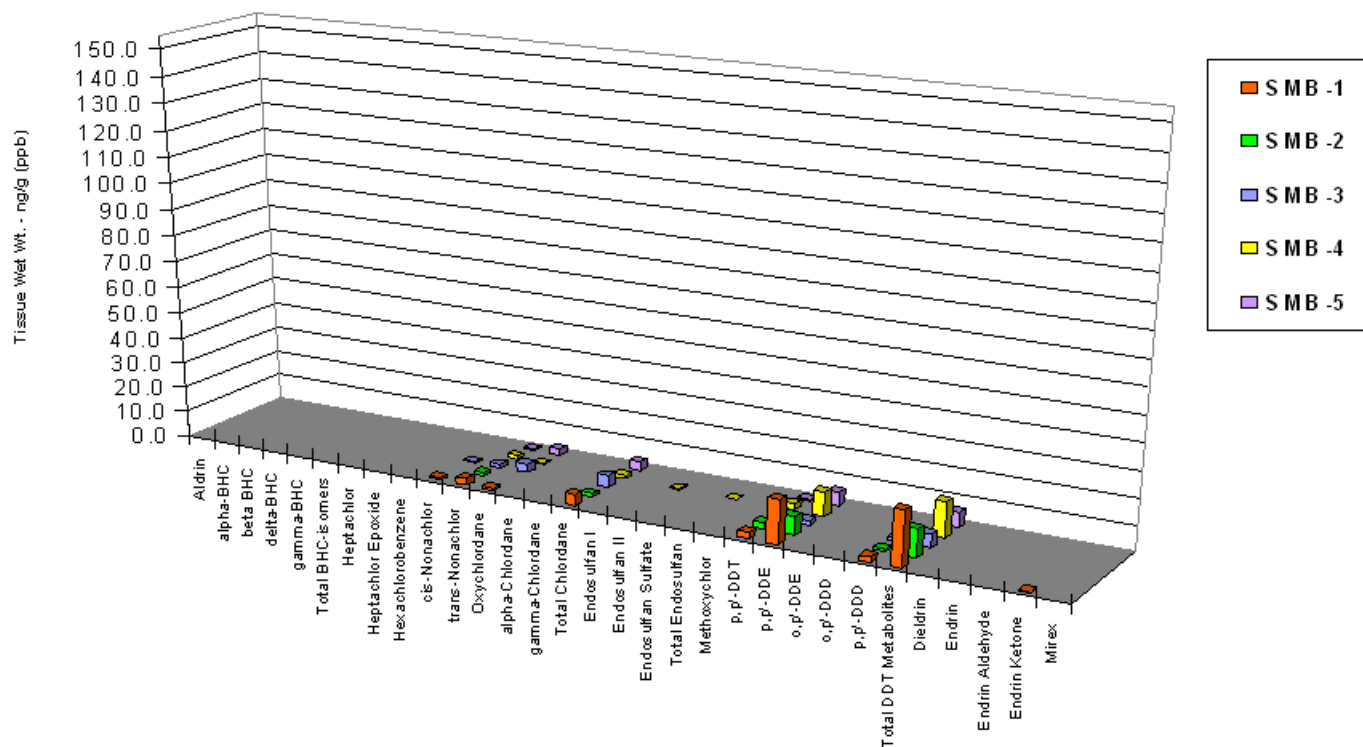
## CT River Reach 5 - Organochlorine Pesticides - Whole Smallmouth Bass



**Figure 91.** CT River Reach 5 - Organochlorine Pesticides in Whole Smallmouth Bass

Four whole SMB composites exceeded the cancer SV for subsistence fisher exposure to total DDT homologs in Reach 5 (Figure 91). Two whole SMB composites exceeded the cancer SV for subsistence fisher exposure to dieldrin. Four whole SMB composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

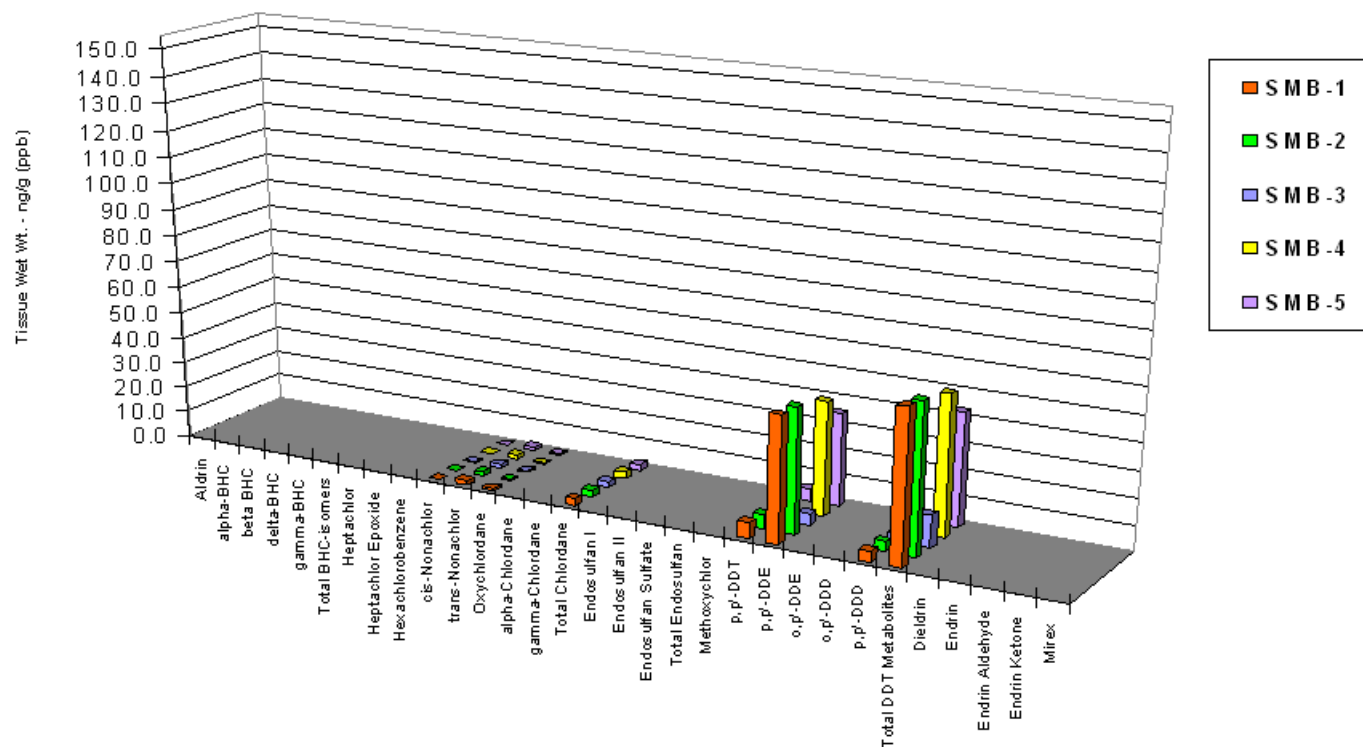
## CT River Reach 6 - Organochlorine Pesticides - Whole Smallmouth Bass



**Figure 92.** CT River Reach 6 - Organochlorine Pesticides in Whole Smallmouth Bass

In Reach 6 one whole SMB composite exceeded the cancer SV for subsistence fisher exposure to total DDT homologs (Figure 92). Four whole SMB composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

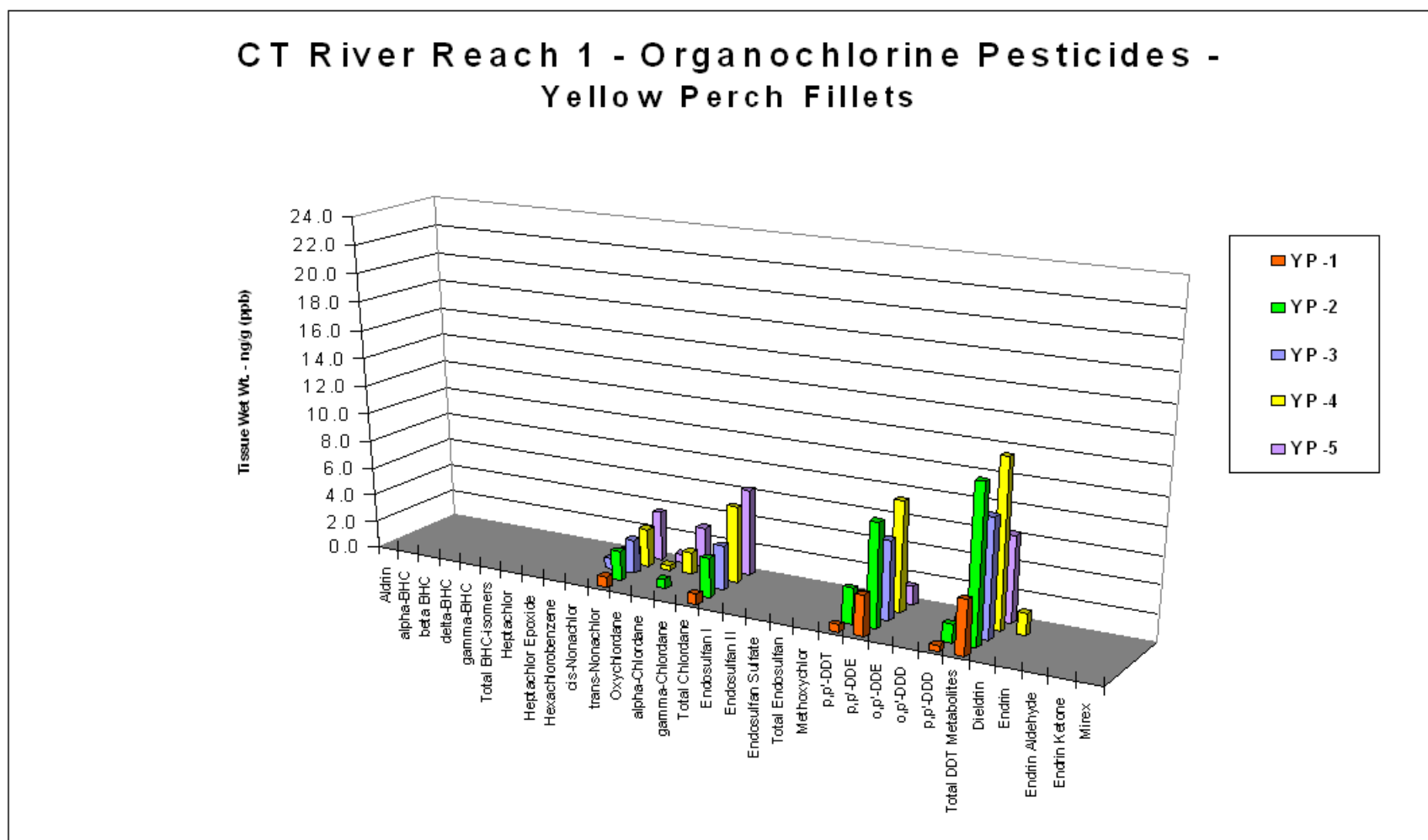
## CT River Reach 7 - Organochlorine Pesticides - Whole Smallmouth Bass



**Figure 93.** CT River Reach 7 - Organochlorine Pesticides in Whole Smallmouth Bass

In Reach 7 four whole SMB composites in Reach 7 exceeded the cancer SV for subsistence fisher exposure to total DDT homologs (Figure 93). Five whole SMB composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

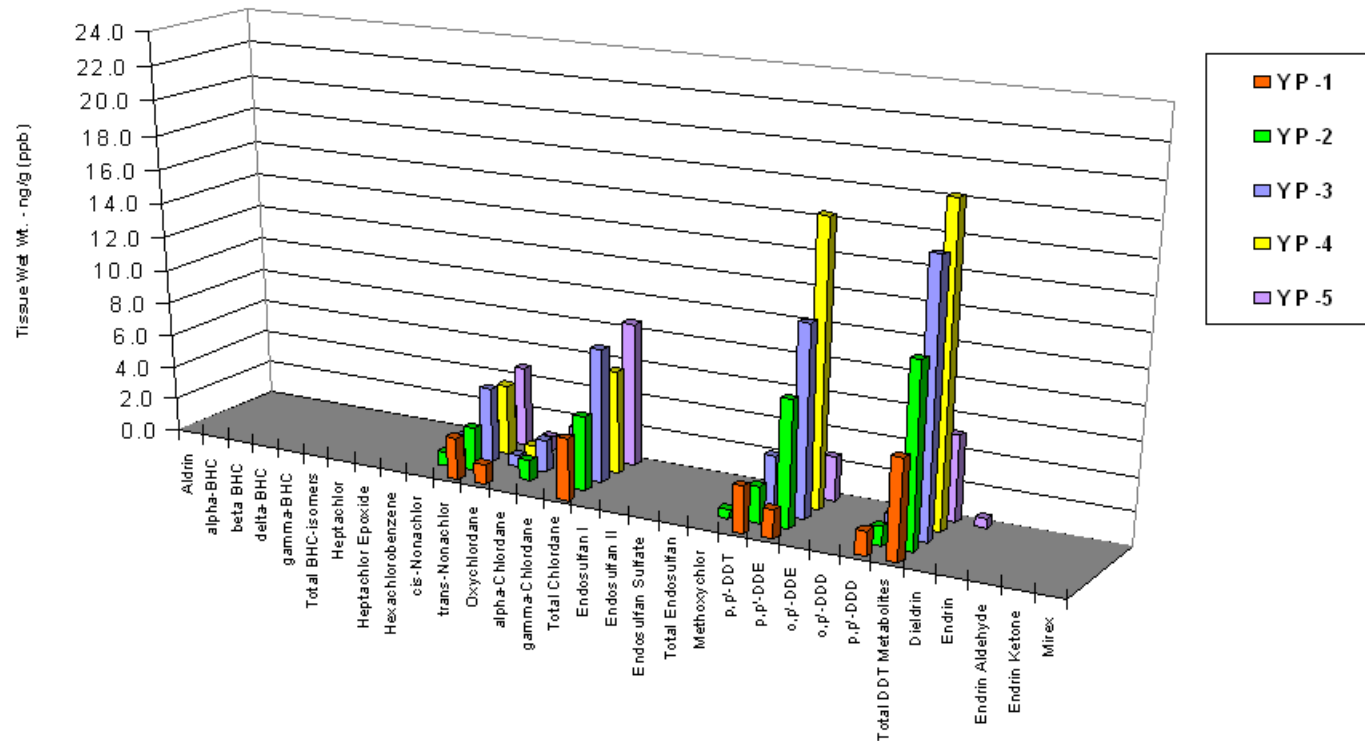
### 4.2.3 Yellow Perch Fillets



**Figure 94.** CT River Reach 1 - Organochlorine Pesticides in Yellow Perch Fillets

Low levels of organochlorine pesticides were observed in all yellow perch (YP) fillet composites in Reach 1 (Figure 94). Only fillet composite exceeded the subsistence fisher carcinogenic screening level (SV) for dieldrin.

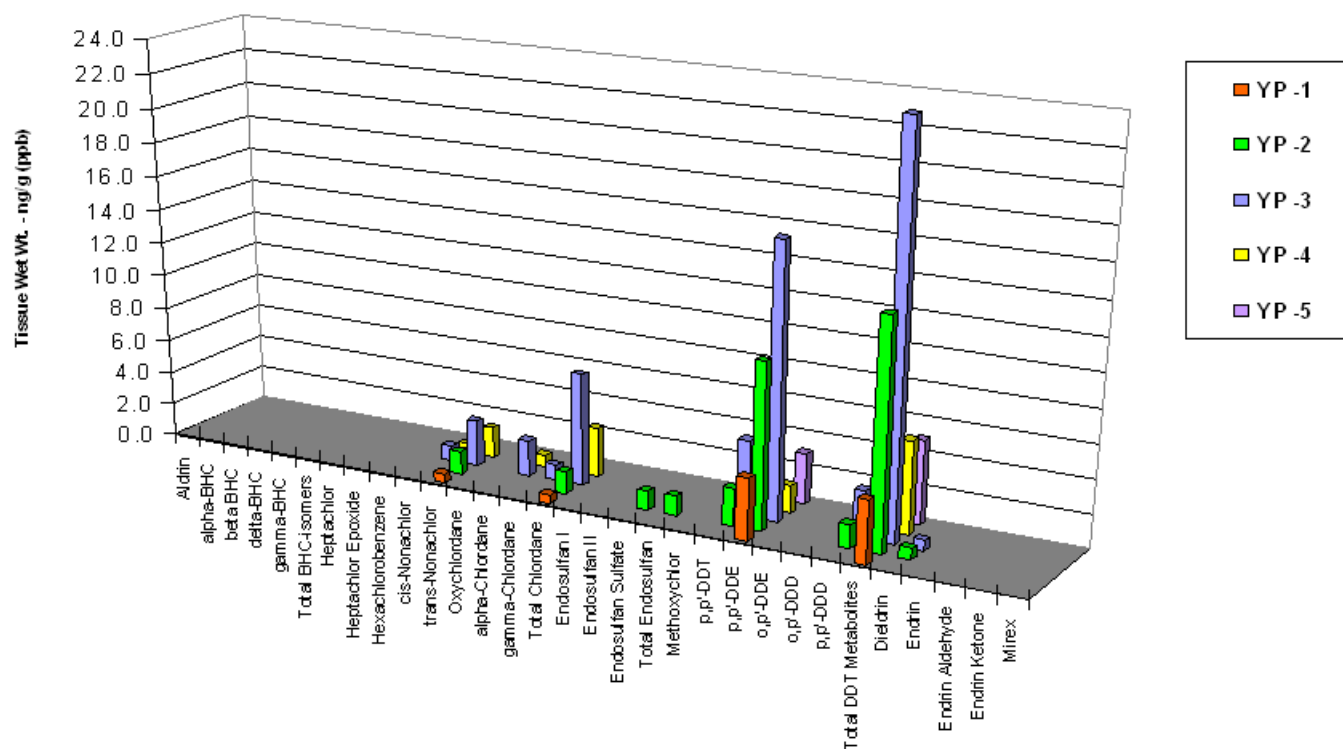
## CT River Reach 2 - Organochlorine Pesticides - Yellow Perch Fillets



**Figure 95.** CT River Reach 2 - Organochlorine Pesticides in Yellow Perch Fillets

In Reach 2 the only human health SVs exceeded were for subsistence fishers for p,p'-DDE in a single fillet composite, two fillet composites for total DDT homologs and one fillet composite for dieldrin (Figure 95).

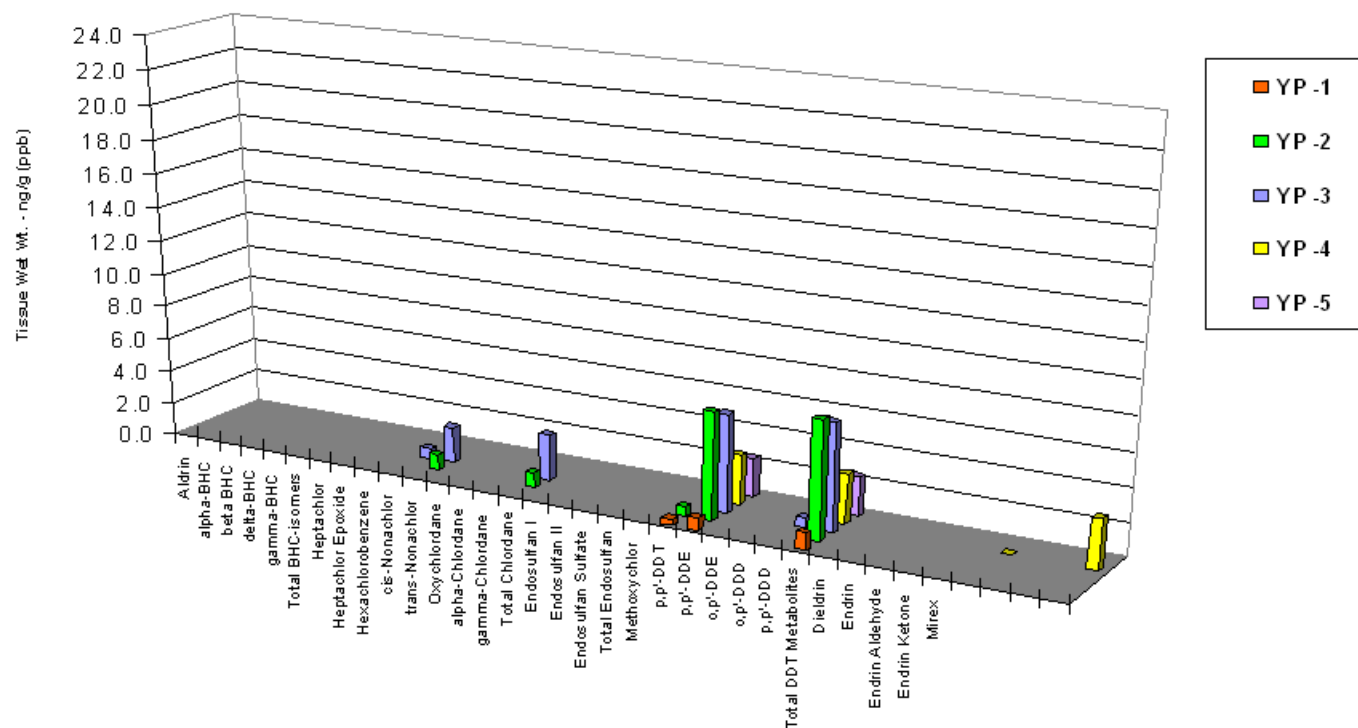
## CT River Reach 3 - Organochlorine Pesticides - Yellow Perch Fillets



**Figure 96.** CT River Reach 3 - Organochlorine Pesticides in Yellow Perch Fillets

In Reach 3 the only human health SVs exceeded were for subsistence fishers for p,p'-DDE and total DDT homologs in one yellow perch fillet composite and for two fillet composites for dieldrin (Figure 96).

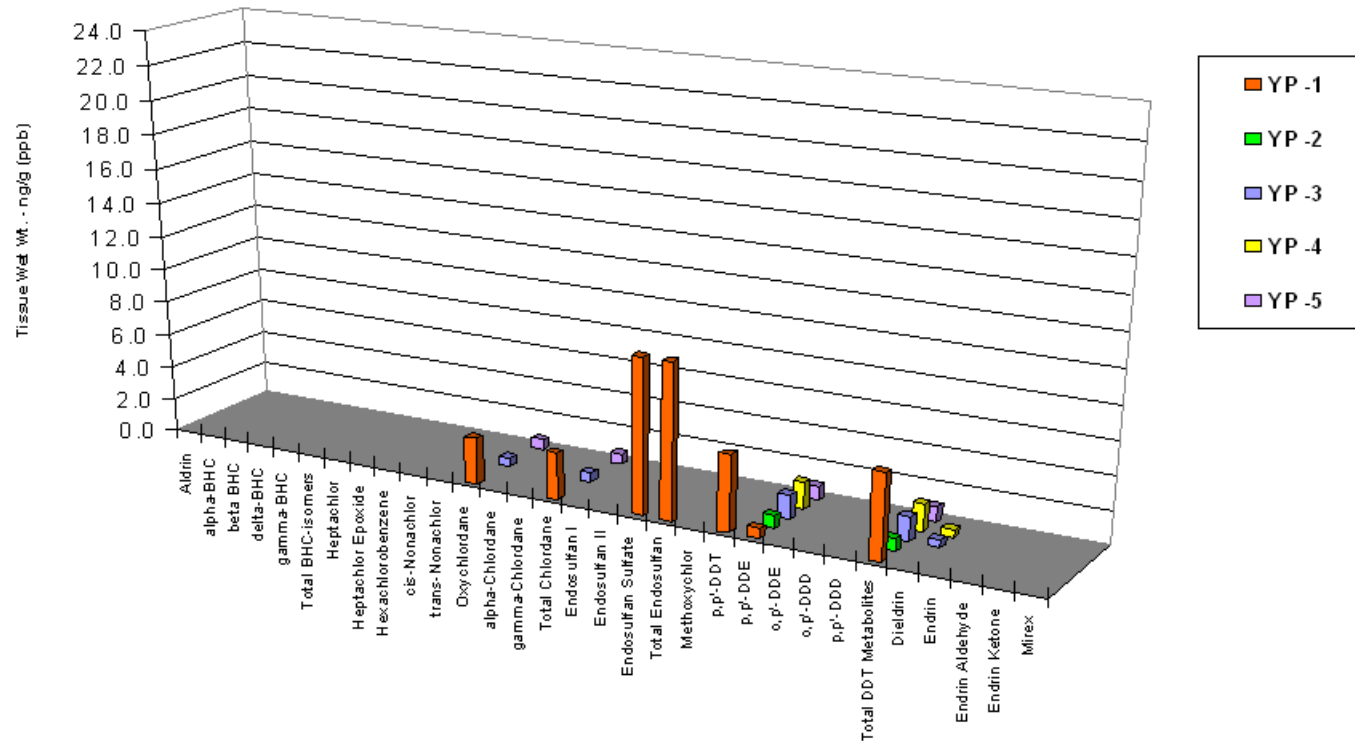
## CT River Reach 4 - Organochlorine Pesticides - Yellow Perch Fillets



**Figure 97.** CT River Reach 4 - Organochlorine Pesticides in Yellow Perch Fillets

No human health screening thresholds were exceeded in yellow perch fillet composites in Reach 4 (Figure 97).

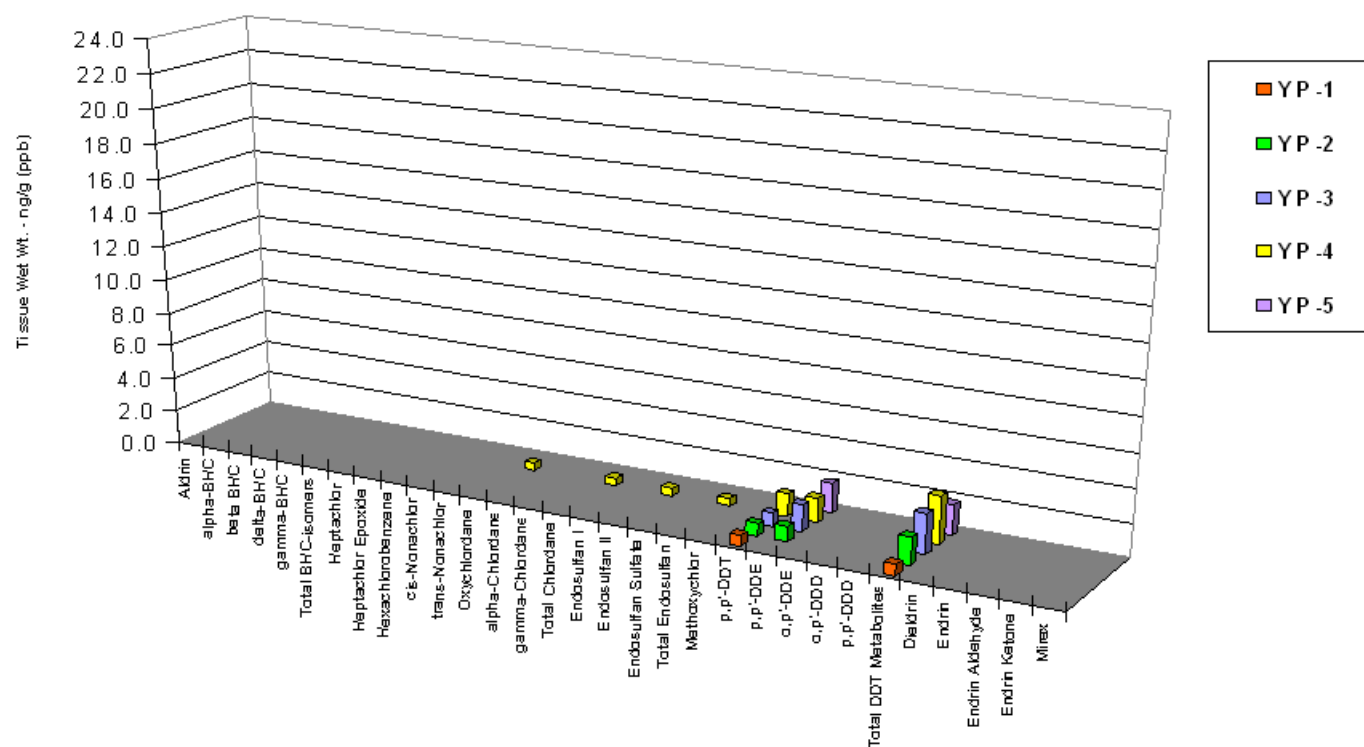
## CT River Reach 5 - Organochlorine Pesticides - Yellow Perch Fillets



**Figure 98.** CT River Reach 5 - Organochlorine Pesticides in Yellow Perch Fillets

In Reach 5 the only human health risk SVs barely exceeded were for two yellow perch fillet composites for dieldrin, for subsistence fishers (Figure 98).

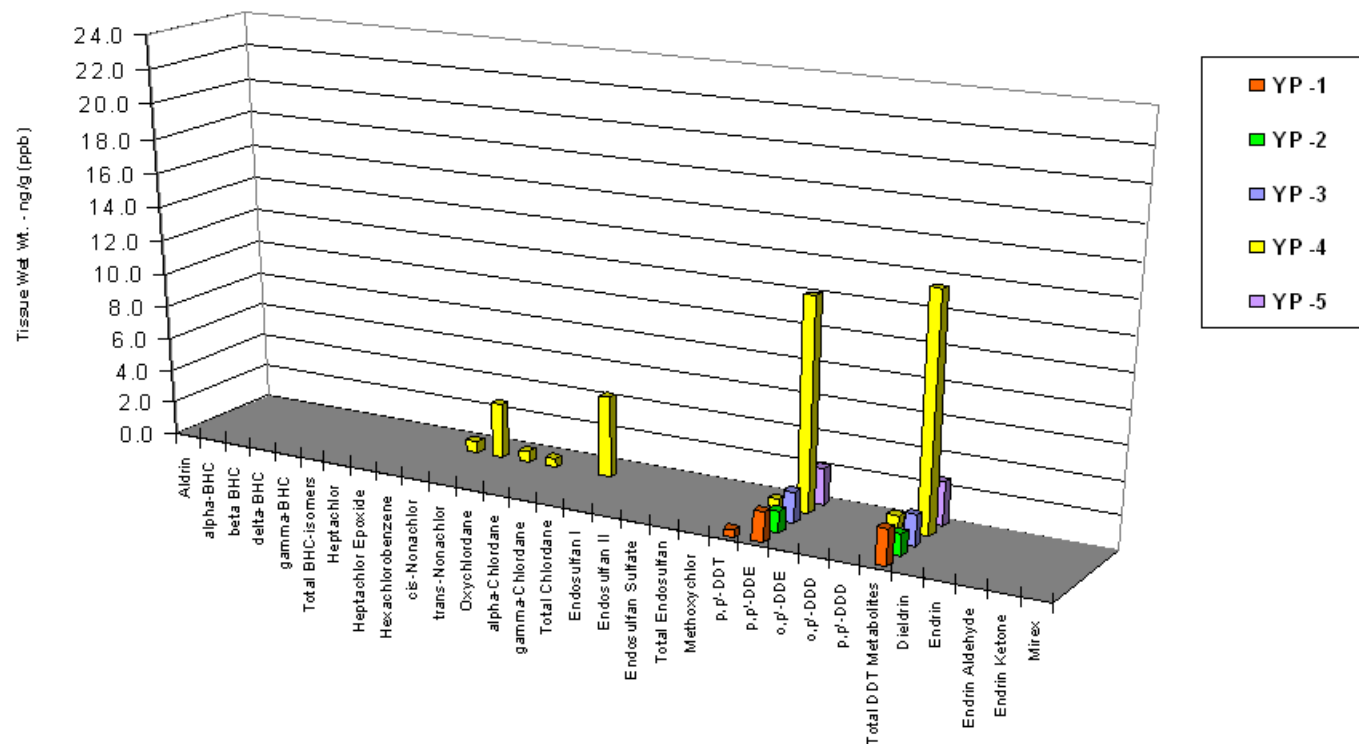
## CT River Reach 6 - Organochlorine Pesticides - Yellow Perch Fillets



**Figure 99.** CT River Reach 6 - Organochlorine Pesticides in Yellow Perch Fillets

No human health risk SVs were exceeded for YP fillet composites in Reach 6 (Figure 99).

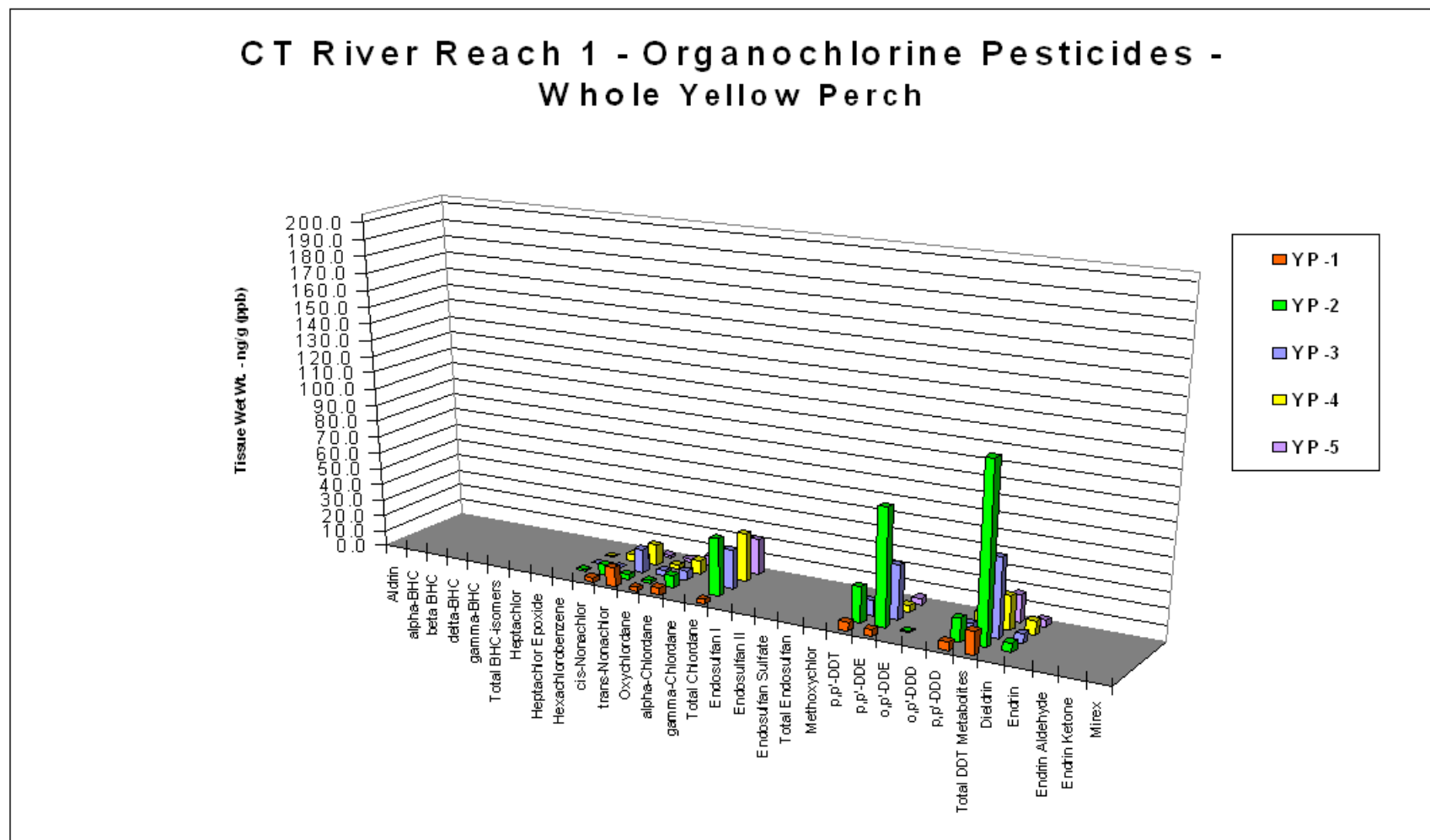
## CT River Reach 7 - Organochlorine Pesticides - Yellow Perch Fillets



**Figure 100.** CT River Reach 7 - Organochlorine Pesticides in Yellow Perch Fillets

No human health risk SVs were exceeded for YP fillet composites in Reach 7 (Figure 100).

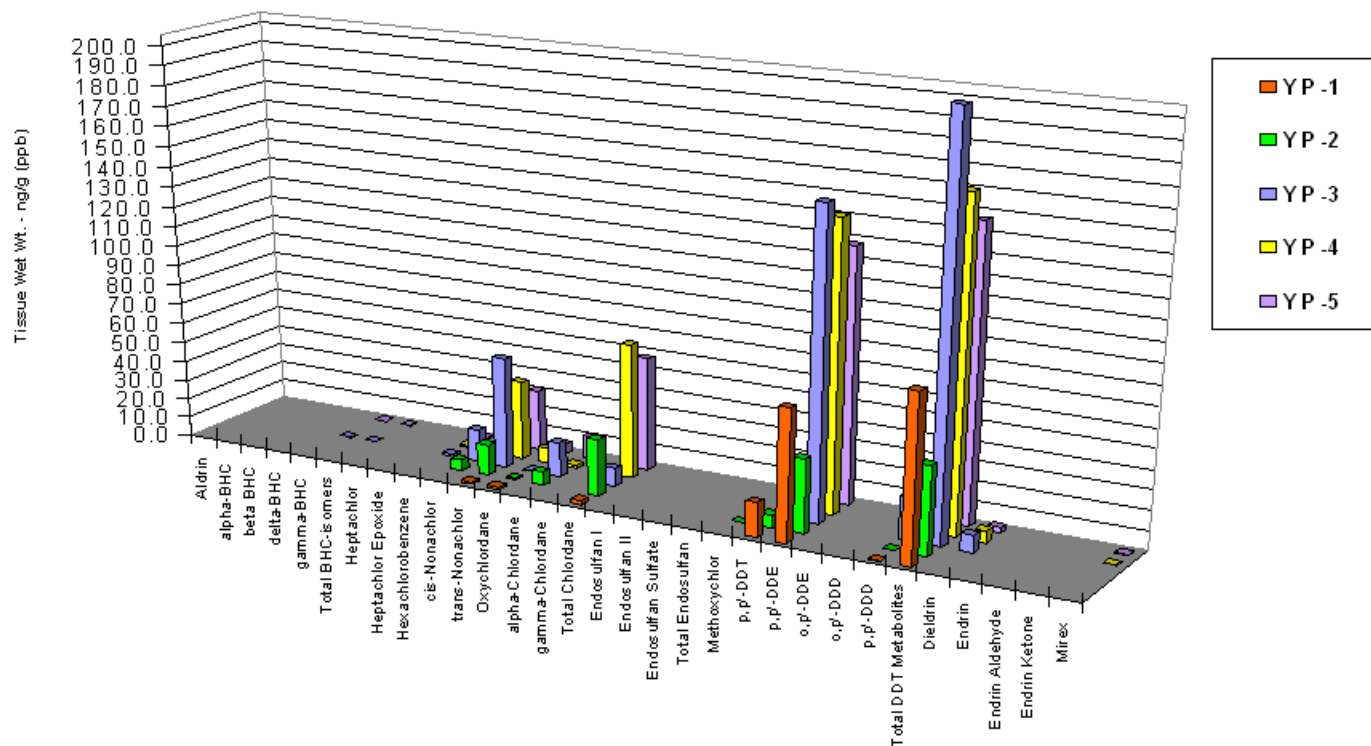
#### 4.2.4 Whole Yellow Perch



**Figure 101.** CT River Reach 1 - Organochlorine Pesticides in Whole Yellow Perch

All fillet composites in Reach 1 exceeded the subsistence fisher carcinogenic SV for total DDT homologs and several exceeded it for p,p'-DDE (Figure 101). The NOAEL level for belted kingfisher exposure to total DDT homologs was also exceeded in several whole YP composites.

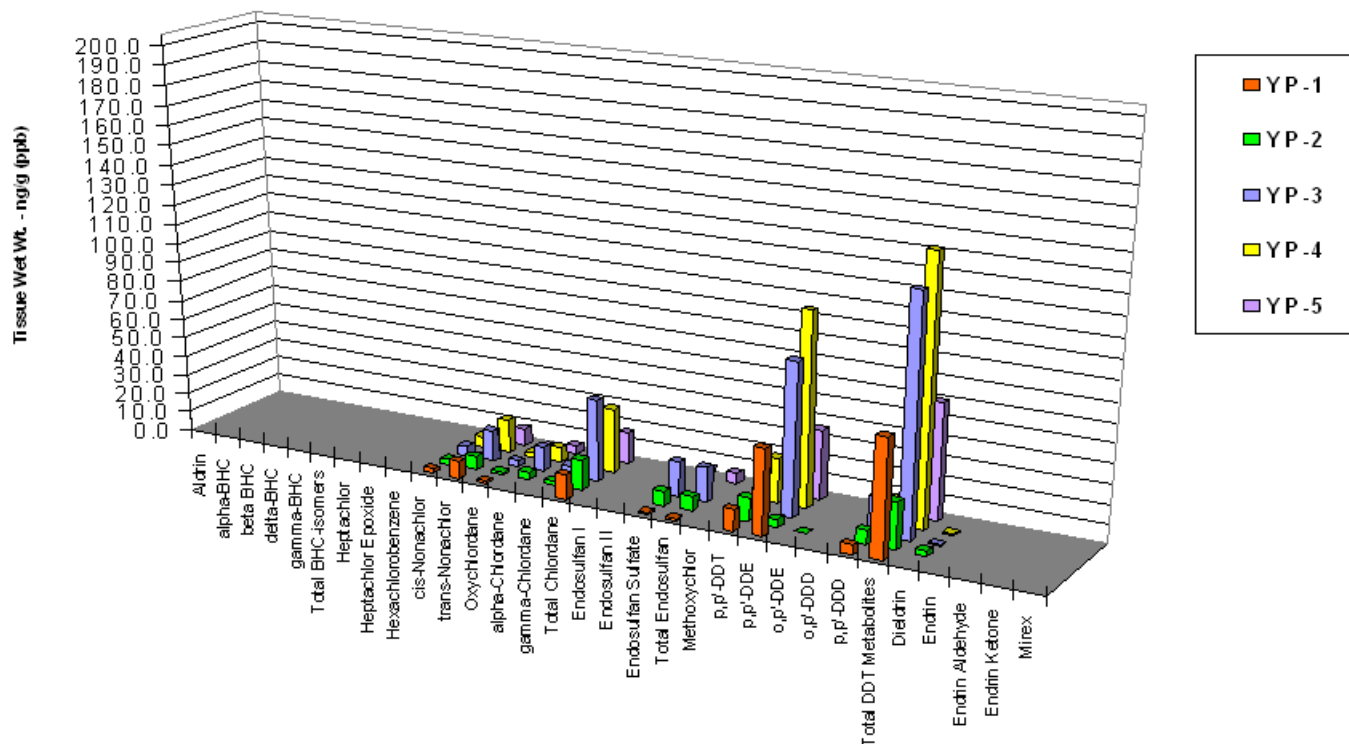
## CT River Reach 2 - Organochlorine Pesticides - Whole Yellow Perch



**Figure 102.** CT River Reach 2 - Organochlorine Pesticides in Whole Yellow Perch

In Reach 2 several whole YP composites exceeded the carcinogenic SV for total chlordane and dieldrin for subsistence fishers (Figure 102). All whole YP composites exceeded subsistence fisher SV for p,p'-DDE and total DDT homologs. All whole YP composites exceeded NOAEL levels for kingfisher for total DDT homologs and several individual DDT homologs.

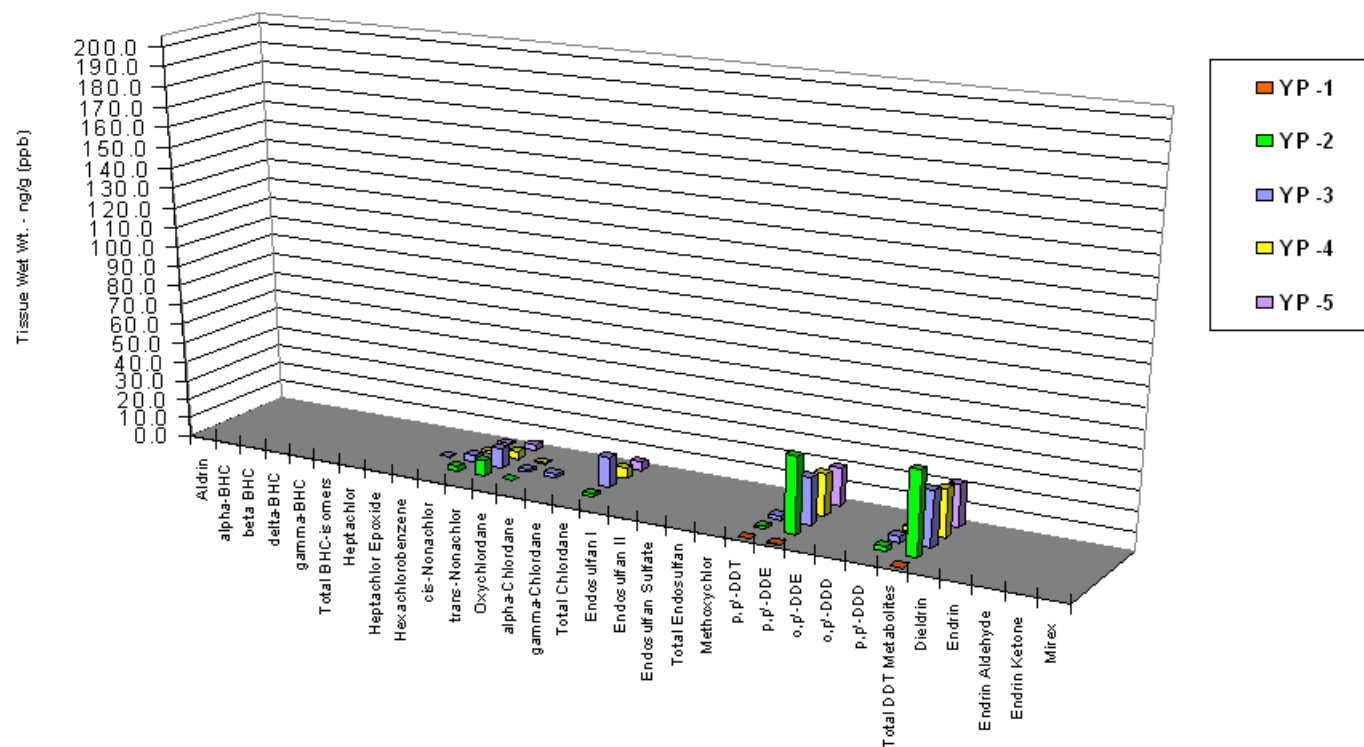
### CT River Reach 3 - Organochlorine Pesticides - Whole Yellow Perch



**Figure 103.** CT River Reach 3 - Organochlorine Pesticides in Whole Yellow Perch

In Reach 3 carcinogenic SVs for subsistence fishers were exceeded for several whole YP composites for total chlordane, total DDT and several individual DDT homologs and dieldrin (Figure 103). All whole YP composites exceeded NOAEL levels for kingfisher for total DDT and several individual DDT homologs.

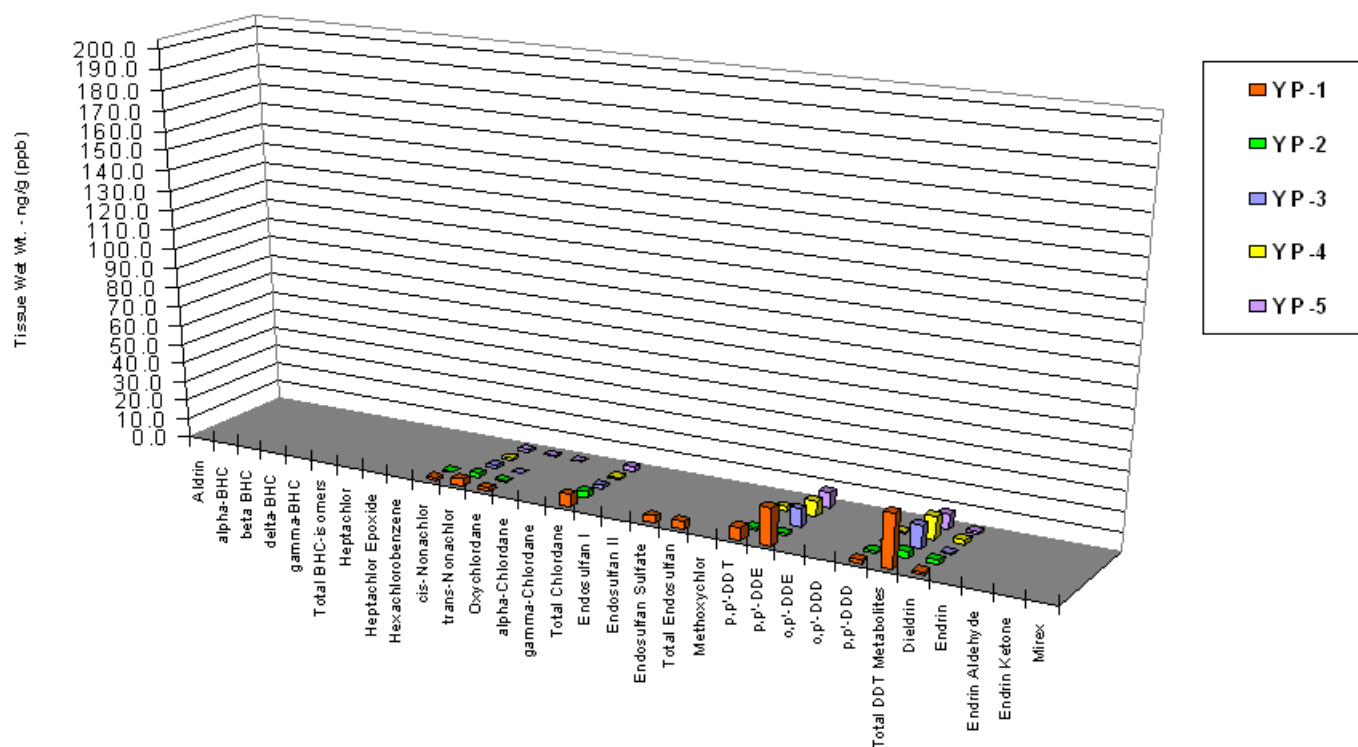
## CT River Reach 4 - Organochlorine Pesticides - Whole Yellow Perch



**Figure 104.** CT River Reach 4 - Organochlorine Pesticides in Whole Yellow Perch

In Reach 4, one whole yellow perch composite barely exceeded the carcinogenic SV for subsistence fishers for total chlordane and four whole YP composites exceeded this level for total DDT homologs and p,p'-DDE (Figure 104). Four whole YP composites exceeded the NOAEL for belted kingfisher for p,p'-DDE and total DDT homologs.

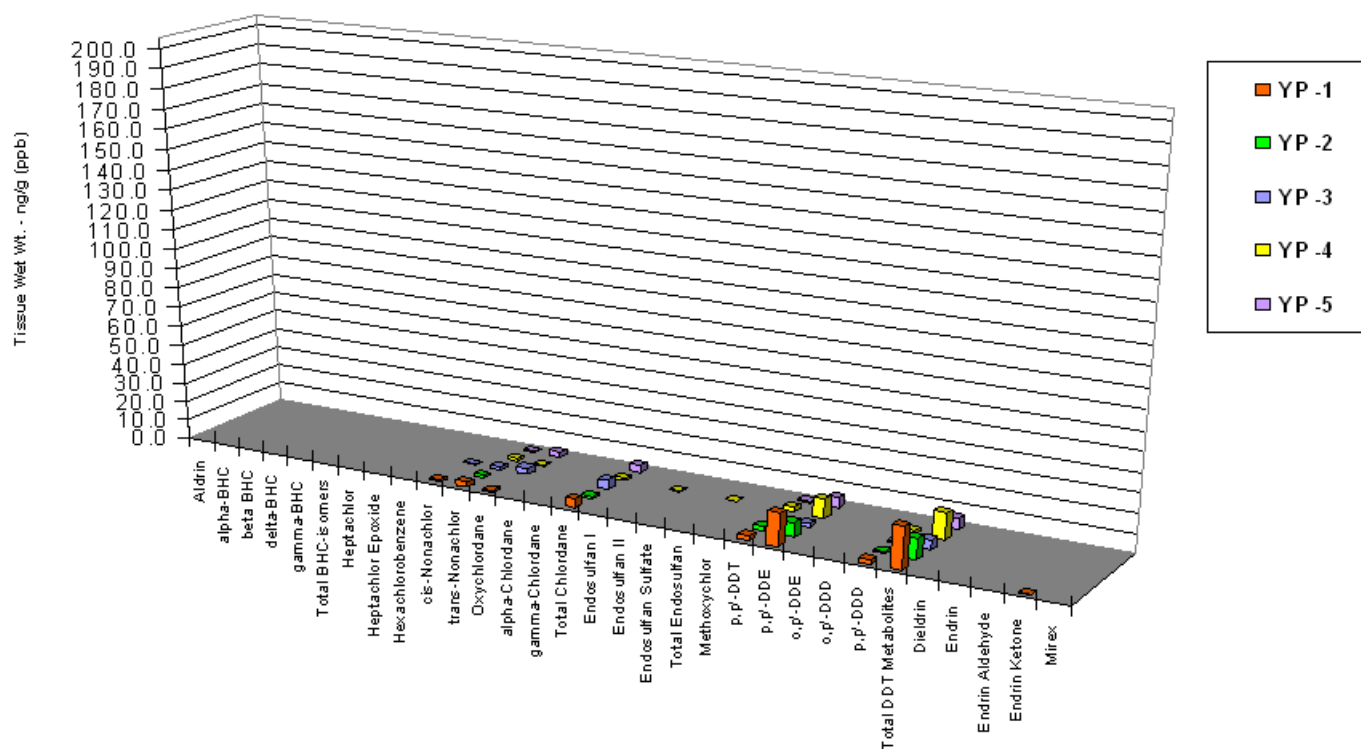
## CT River Reach 5 - Organochlorine Pesticides - Whole Yellow Perch



**Figure 105.** CT River Reach 5 - Organochlorine Pesticides in Whole Yellow Perch

In Reach 5 all whole YP composites exceeded the carcinogenic SV for dieldrin for subsistence fishers (Figure 105). Four whole YP composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

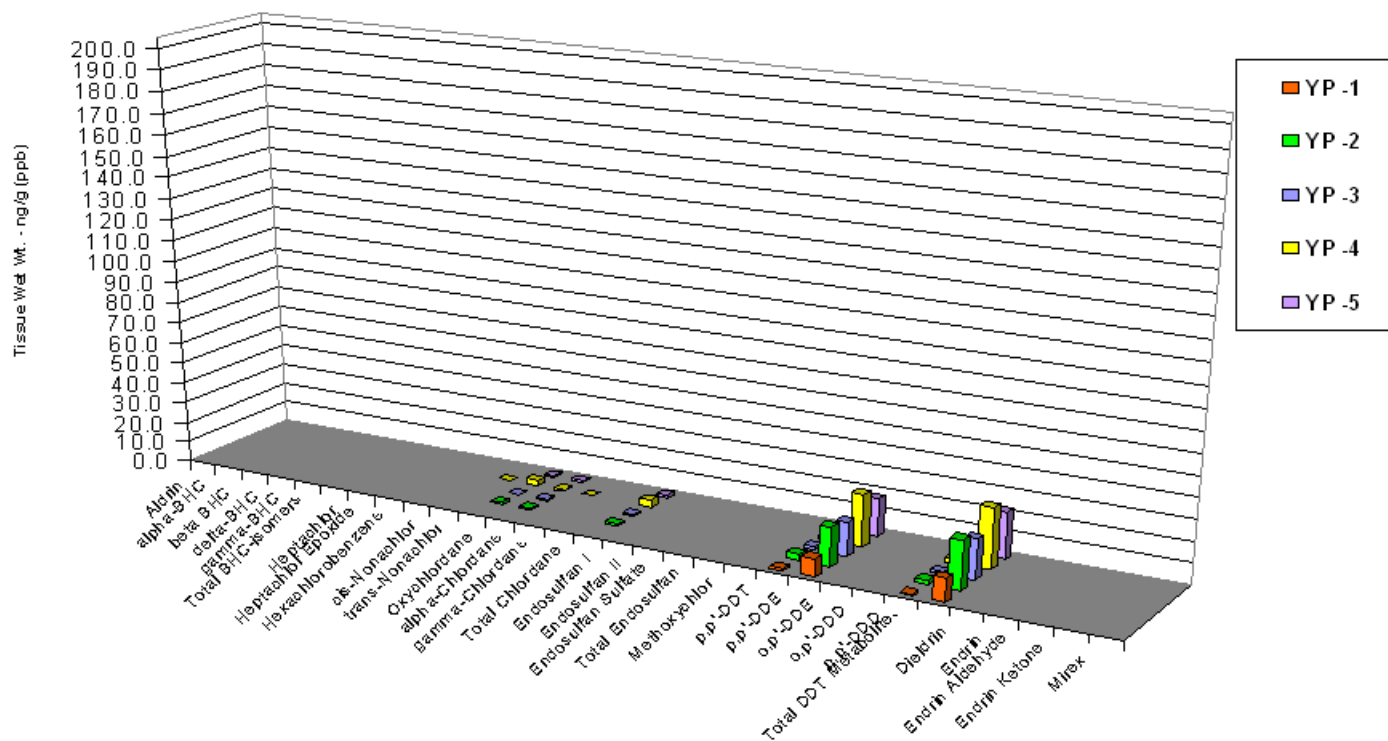
## CT River Reach 6 - Organochlorine Pesticides - Whole Yellow Perch



**Figure 106.** CT River Reach 6 - Organochlorine Pesticides in Whole Yellow Perch

In Reach 6 one whole YP composite barely exceeded the carcinogenic SV for subsistence fishers for total DDT homologs (Figure 106). Four whole YP composites exceed the NOAEL for belted kingfisher exposure to total DDT homologs.

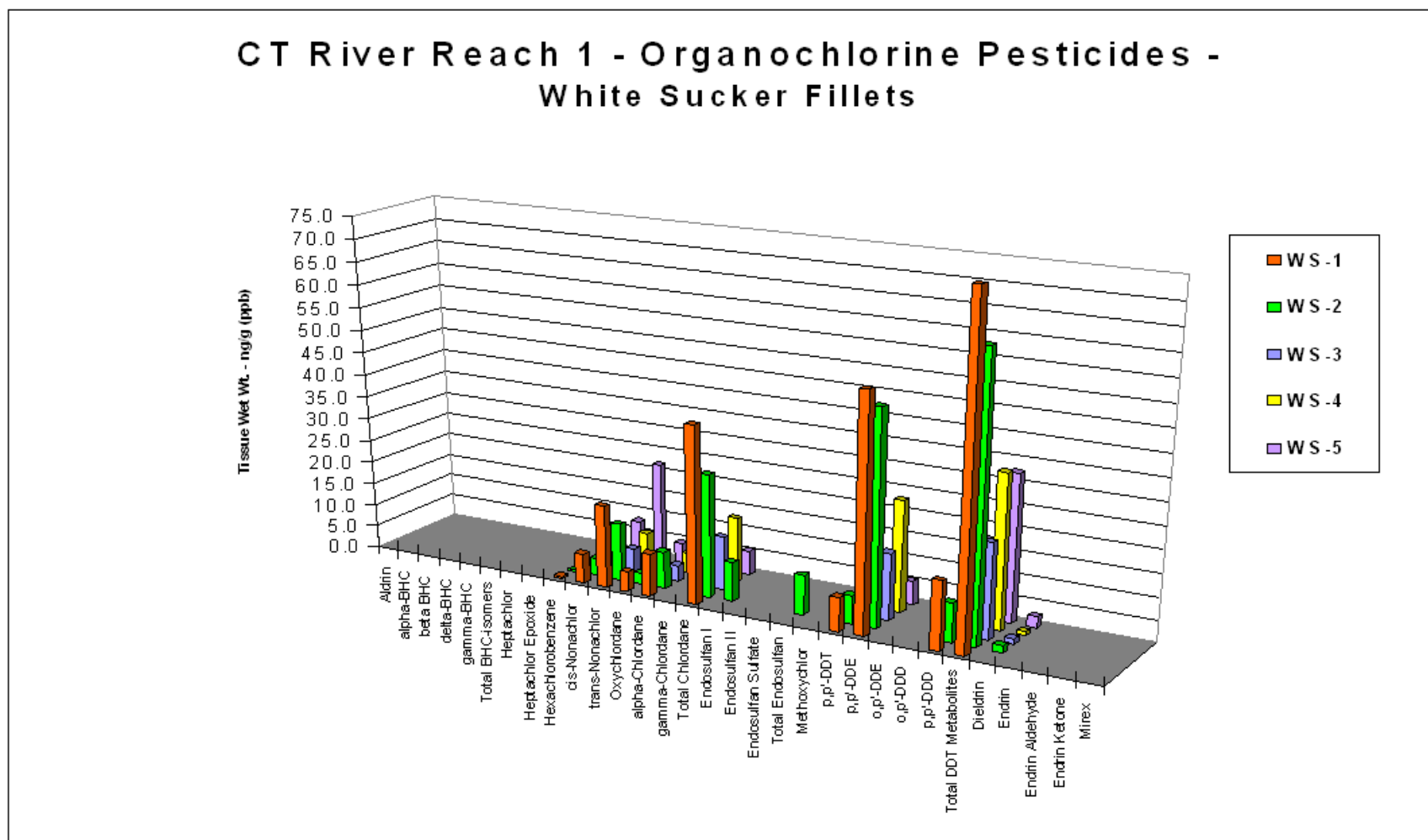
## CT River Reach 7 - Organochlorine Pesticides - Whole Yellow Perch



**Figure 107.** CT River Reach 7 - Organochlorine Pesticides in Whole Yellow Perch

In Reach 7 four whole YP composites exceeded the carcinogenic SV for subsistence fishers for total DDT homologs (Figure 107). All whole YP composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

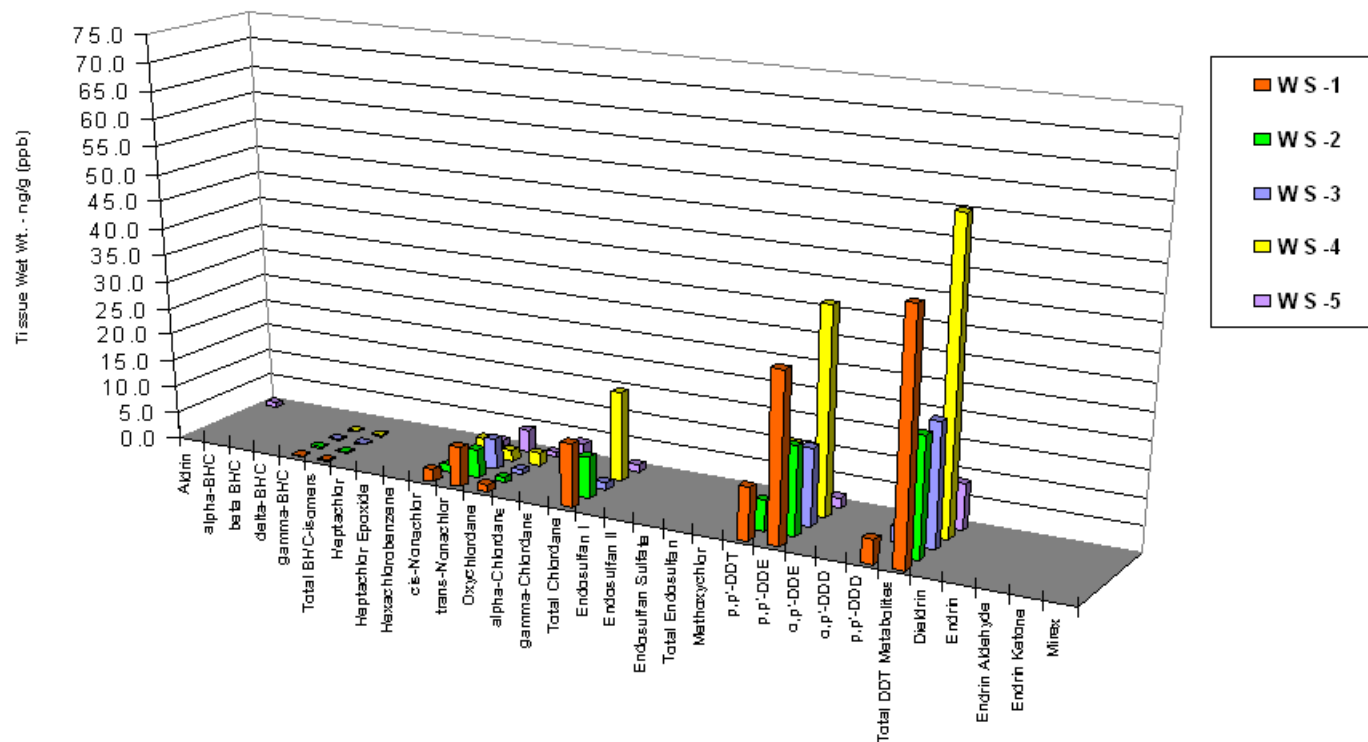
#### 4.2.5 White Sucker Fillets



**Figure 108.** CT River Reach 1 - Organochlorine Pesticides in White Sucker Fillets

Three white sucker (WS) fillet composites in Reach 1 exceeded the cancer SV for subsistence fisher exposure to total chlordane (Figure 108) . Five WS fillet composites exceeded the cancer SV for subsistence fisher exposure to total DDT homologs. Three fillet composites exceeded the subsistence fisher cancer SV for exposure to dieldrin, while one fillet composite barely exceeded the recreational fisher level.

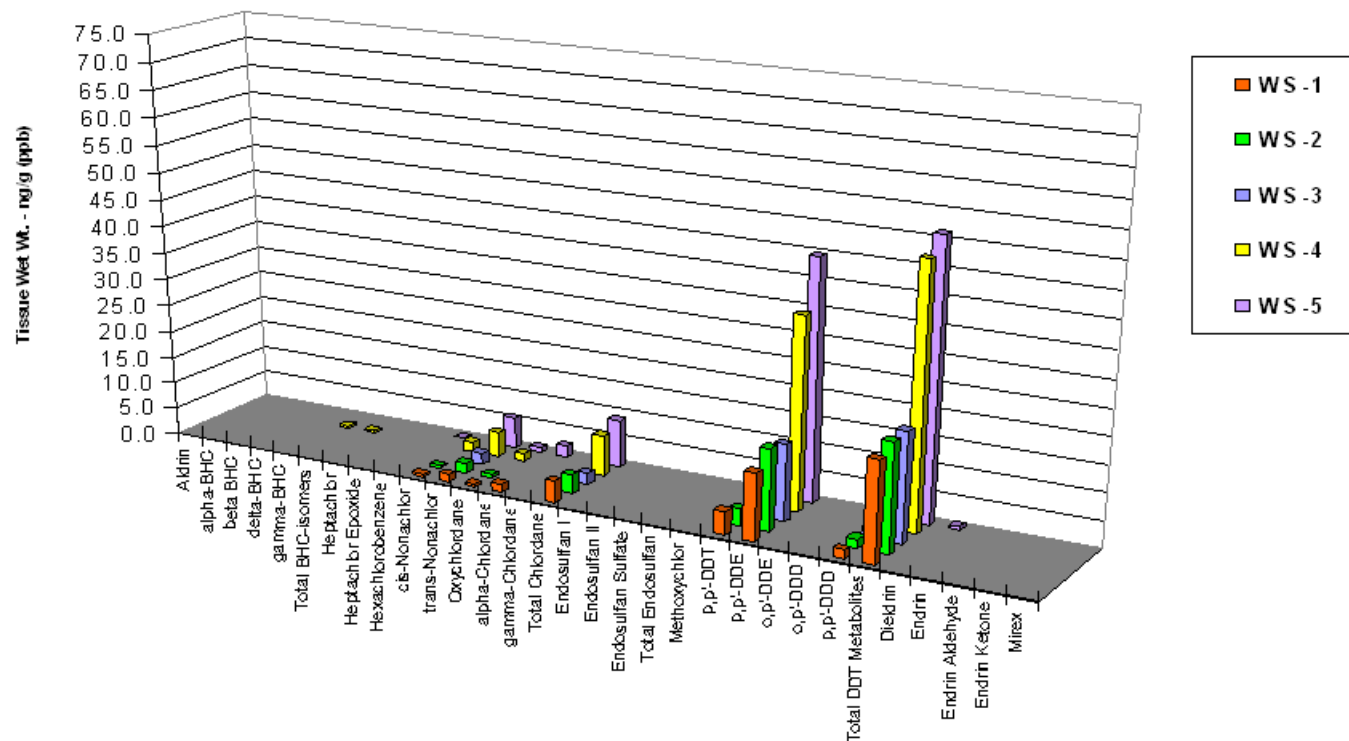
## CT River Reach 2 - Organochlorine Pesticides - White Sucker Fillets



**Figure 109.** CT River Reach 2 - Organochlorine Pesticides in White Sucker Fillets

One WS fillet composite in Reach 2 barely exceeded the cancer SV for subsistence fishers for exposure to total chlordane (Figure 109). Four WS fillet composites exceeded the cancer SV for subsistence fishers for exposure to total DDT homologs.

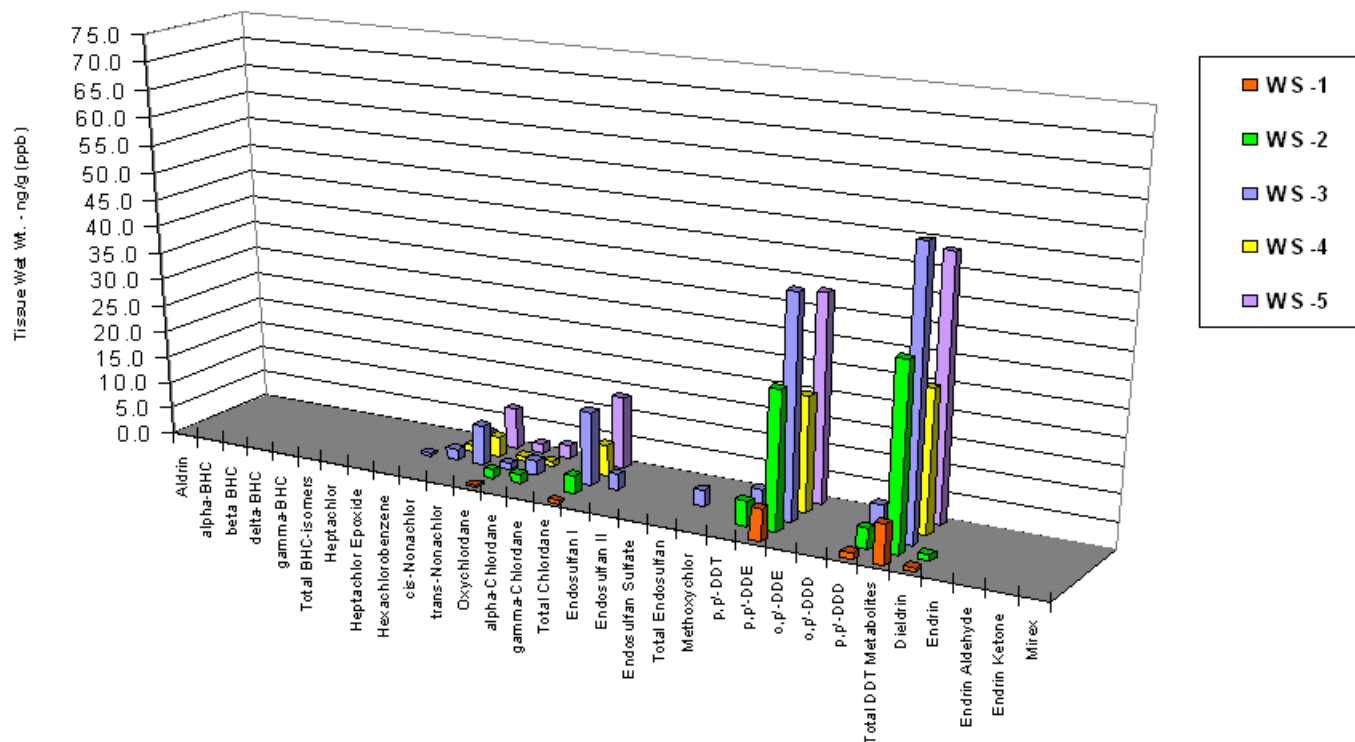
## CT River Reach 3 - Organochlorine Pesticides - White Sucker Fillets



**Figure 110.** CT River Reach 3 - Organochlorine Pesticides in White Sucker Fillets

Five WS fillet composites in Reach 3 exceeded the cancer SV for subsistence fishers exposure to total DDT homologs (Figure 110). One WS fillet composite exceeded the cancer SV for subsistence fishers exposure to dieldrin.

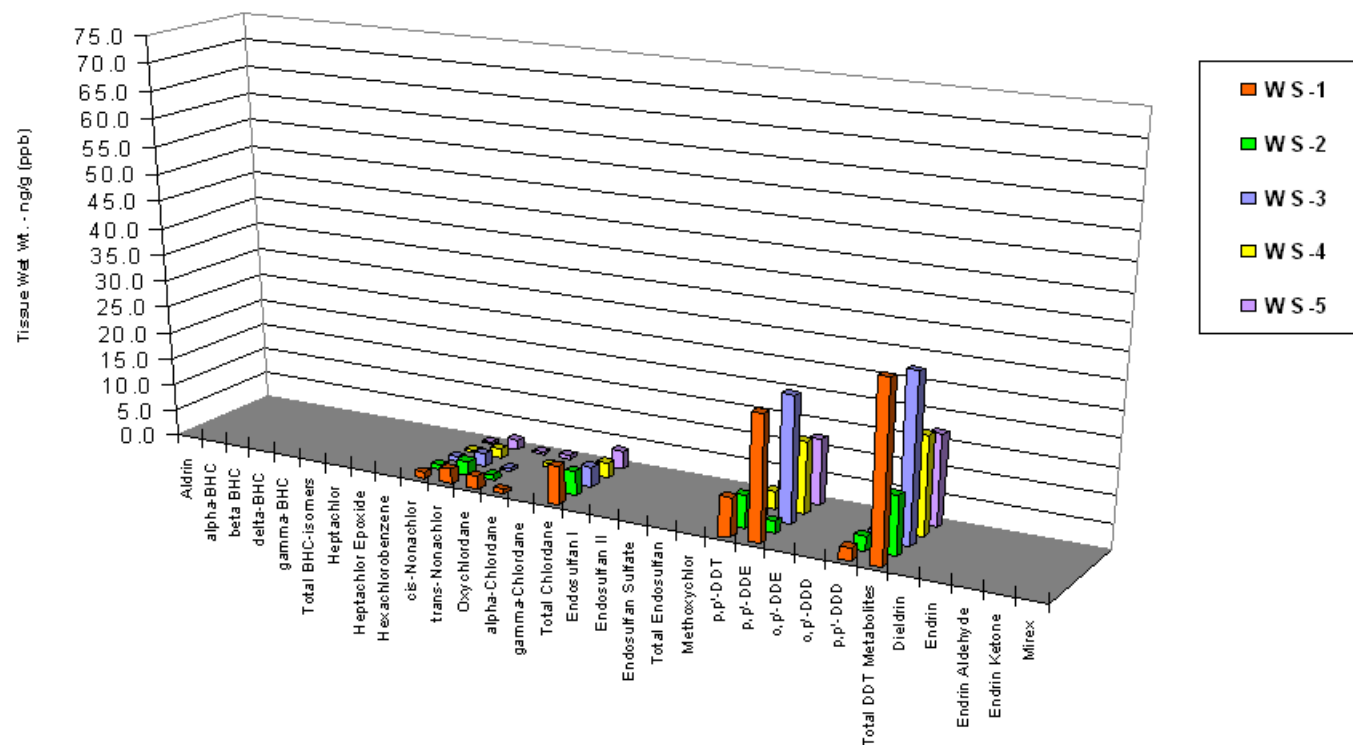
## CT River Reach 4 - Organochlorine Pesticides - White Sucker Fillets



**Figure 111.** CT River Reach 4 - Organochlorine Pesticides in White Sucker Fillets

Four WS fillet composites in Reach 4 exceeded the cancer SV for subsistence fishers exposure to total DDT homologs (Figure 111).

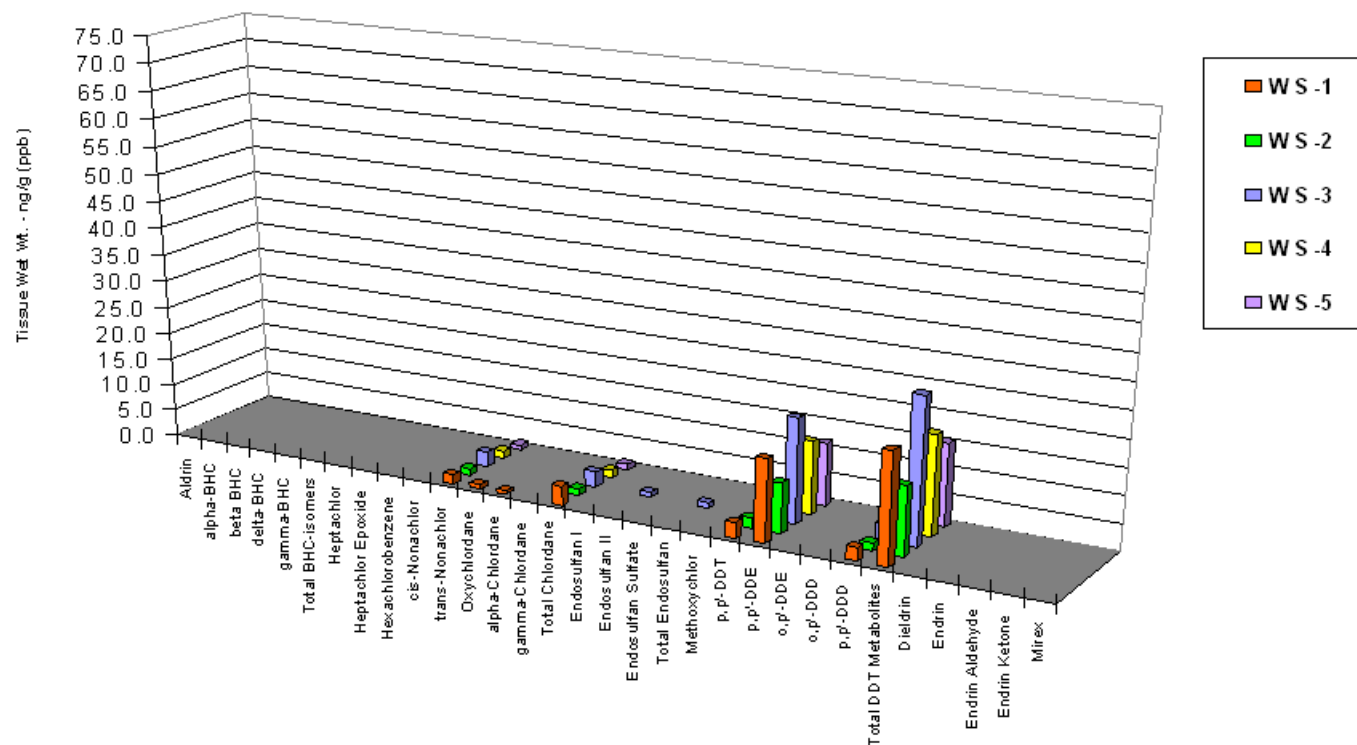
## CT River Reach 5 - Organochlorine Pesticides - White Sucker Fillets



**Figure 112.** CT River Reach 5 - Organochlorine Pesticides in White Sucker Fillets

Five WS fillet composites in Reach 5 exceeded the cancer SV for subsistence fishers exposure to total DDT homologs (Figure 112).

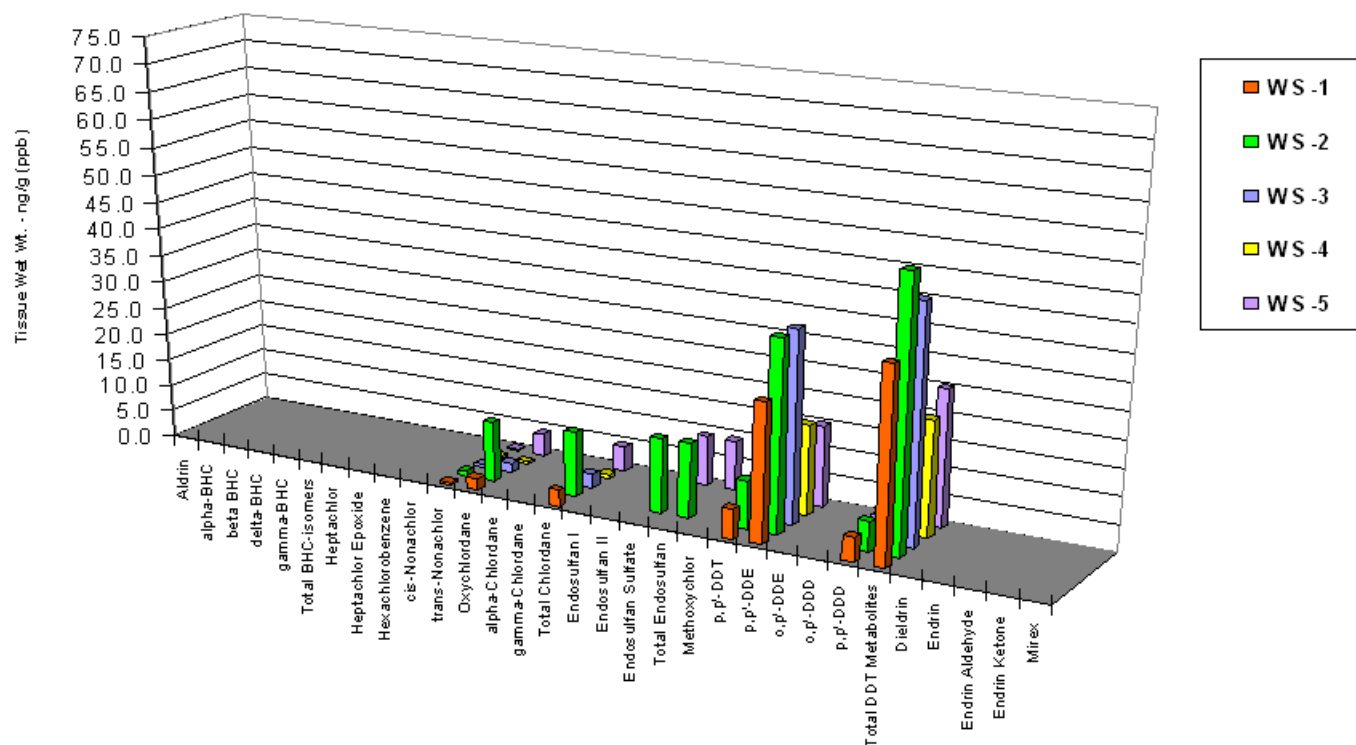
## CT River Reach 6 - Organochlorine Pesticides - White Sucker Fillets



**Figure 113.** CT River Reach 6 - Organochlorine Pesticides in White Sucker Fillets

Four WS fillet composites in Reach 6 exceeded the cancer SV for subsistence fishers exposure to total DDT homologs (Figure 113).

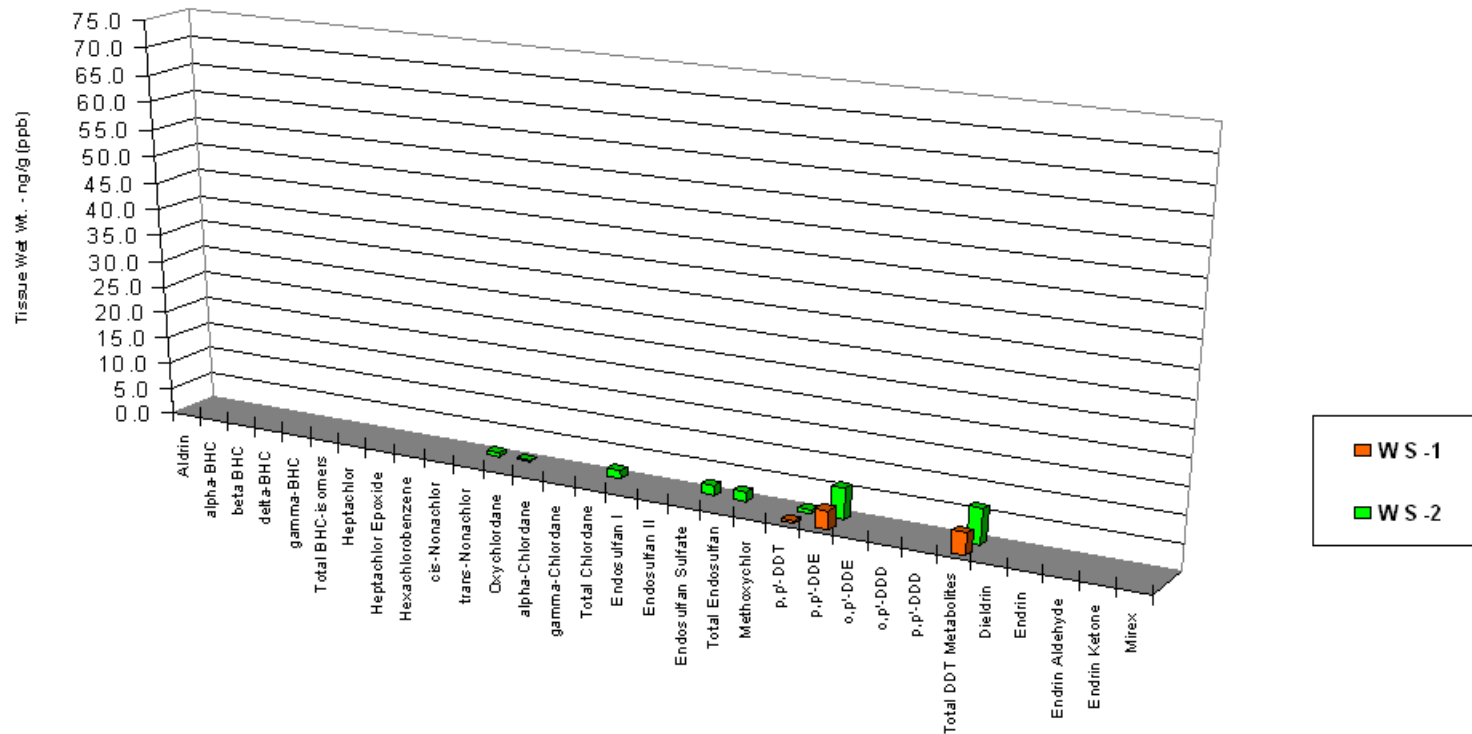
## CT River Reach 7 - Organochlorine Pesticides - White Sucker Fillets



**Figure 114.** CT River Reach 7 - Organochlorine Pesticides in White Sucker Fillets

All WS fillet composites in Reach 7 exceeded the cancer SV for subsistence fishers exposure to total DDT homologs (Figure 114).

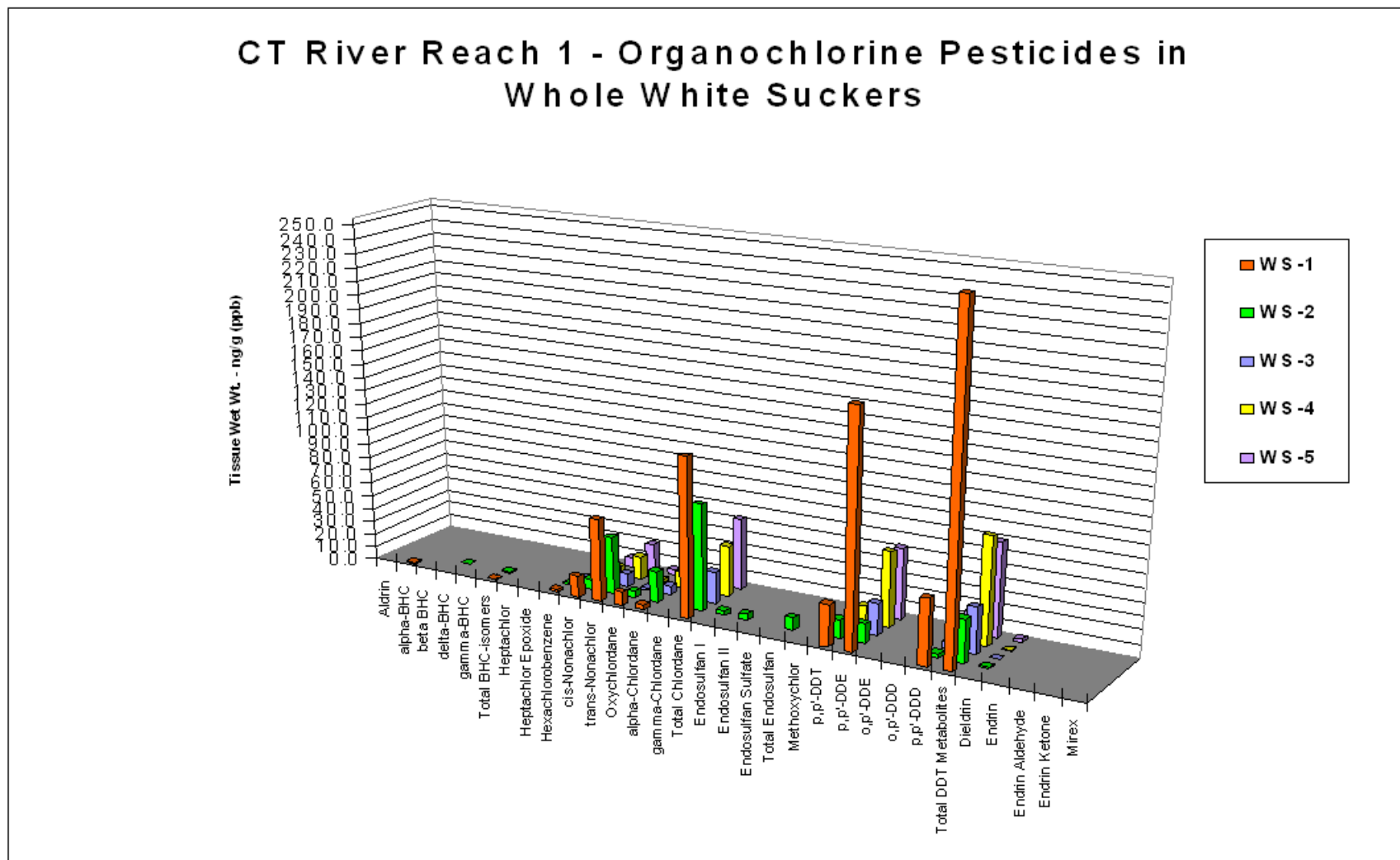
## CT River Reach 8 - Organochlorine Pesticides - White Sucker Fillets



**Figure 115.** CT River Reach 8 - Organochlorine Pesticides in White Sucker Fillets

One WS fillet composite in Reach 8 barely exceeded cancer SV for subsistence fishers exposure to total DDT homologs (Figure 115).

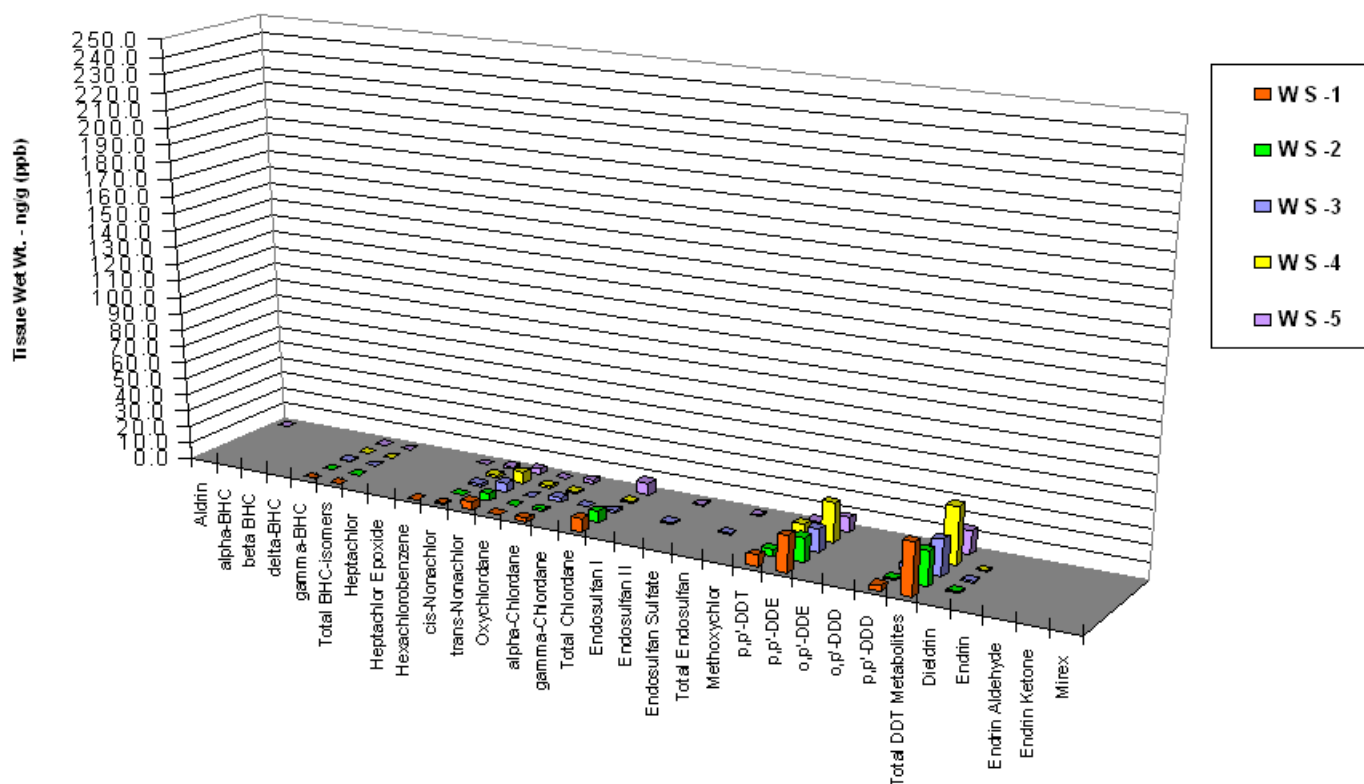
#### 4.2.6 Whole White Suckers



**Figure 116.** CT River Reach 1 - Organochlorine Pesticides in Whole White Suckers

All whole WS composites in Reach 1 exceeded the cancer SV for subsistence fisher exposure to total chlordane (Figure 116). All whole WS composites exceeded the cancer SV for subsistence fishers exposure to total DDT homologs. Four whole WS composites exceeded the cancer SV for subsistence fishers exposure to dieldrin. All whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

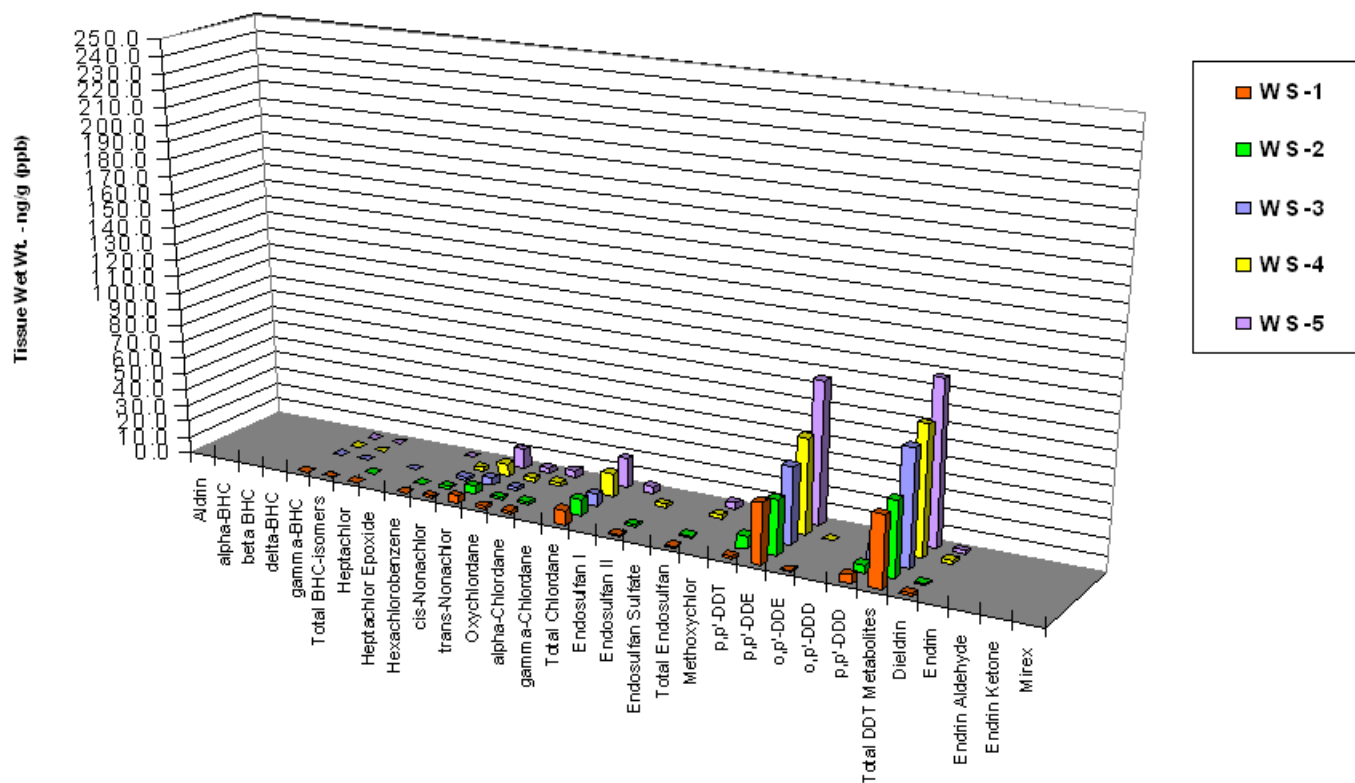
## CT River Reach 2 - Organochlorine Pesticides in Whole White Suckers



**Figure 117.** CT River Reach 2 - Organochlorine Pesticides in Whole White Suckers

All whole WS composites in Reach 2 exceeded the cancer SV for subsistence fisher exposure to total DDT homologs (Figure 117). Two whole WS composites exceeded the cancer SV for subsistence fisher exposure to dieldrin. All whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

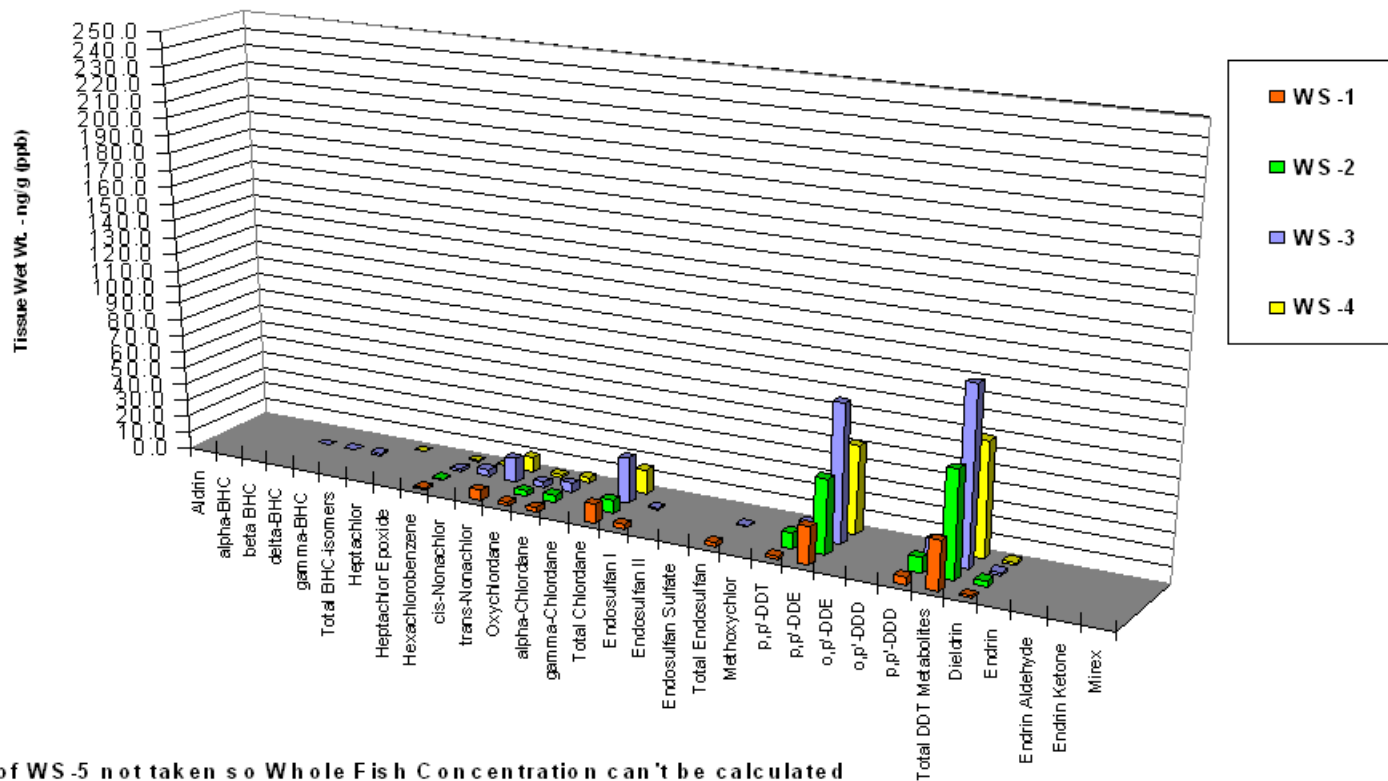
## CT River Reach 3 - Organochlorine Pesticides in Whole White Suckers



**Figure 118.** CT River Reach 3 - Organochlorine Pesticides in Whole White Suckers

Two whole WS composites in Reach 3 exceeded the cancer SV for subsistence fisher exposure to total chlordane (Figure 118). All whole WS composites exceeded the cancer SV for subsistence fisher exposure to total DDT homologs. All whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

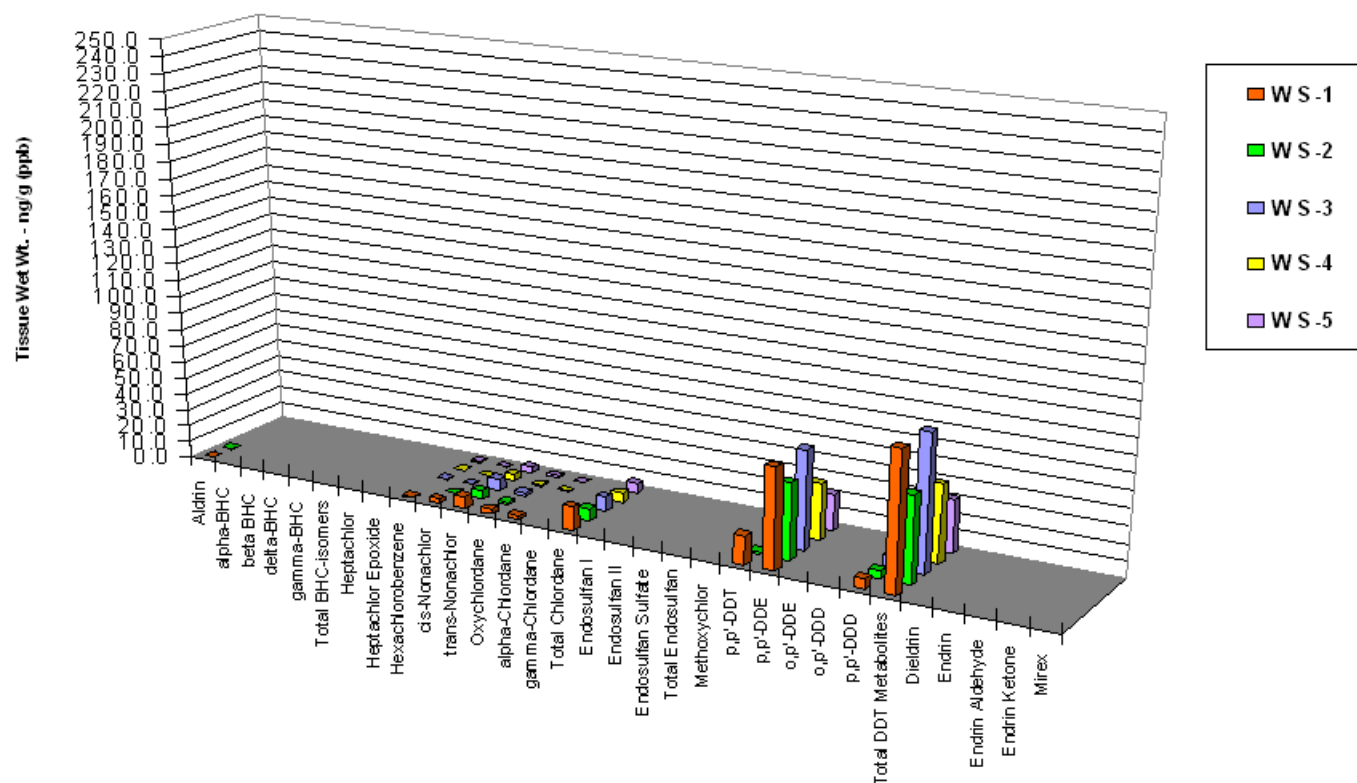
## CT River Reach 4 - Organochlorine Pesticides in Whole White Suckers



**Figure 119.** CT River Reach 4 - Organochlorine Pesticides in Whole White Suckers

Two whole WS composites in Reach 4 exceeded the cancer SV for subsistence fisher exposure to total chlordane (Figure 119). Four whole WS composites exceeded the cancer SV for subsistence fisher exposure to total DDT homologs. All whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

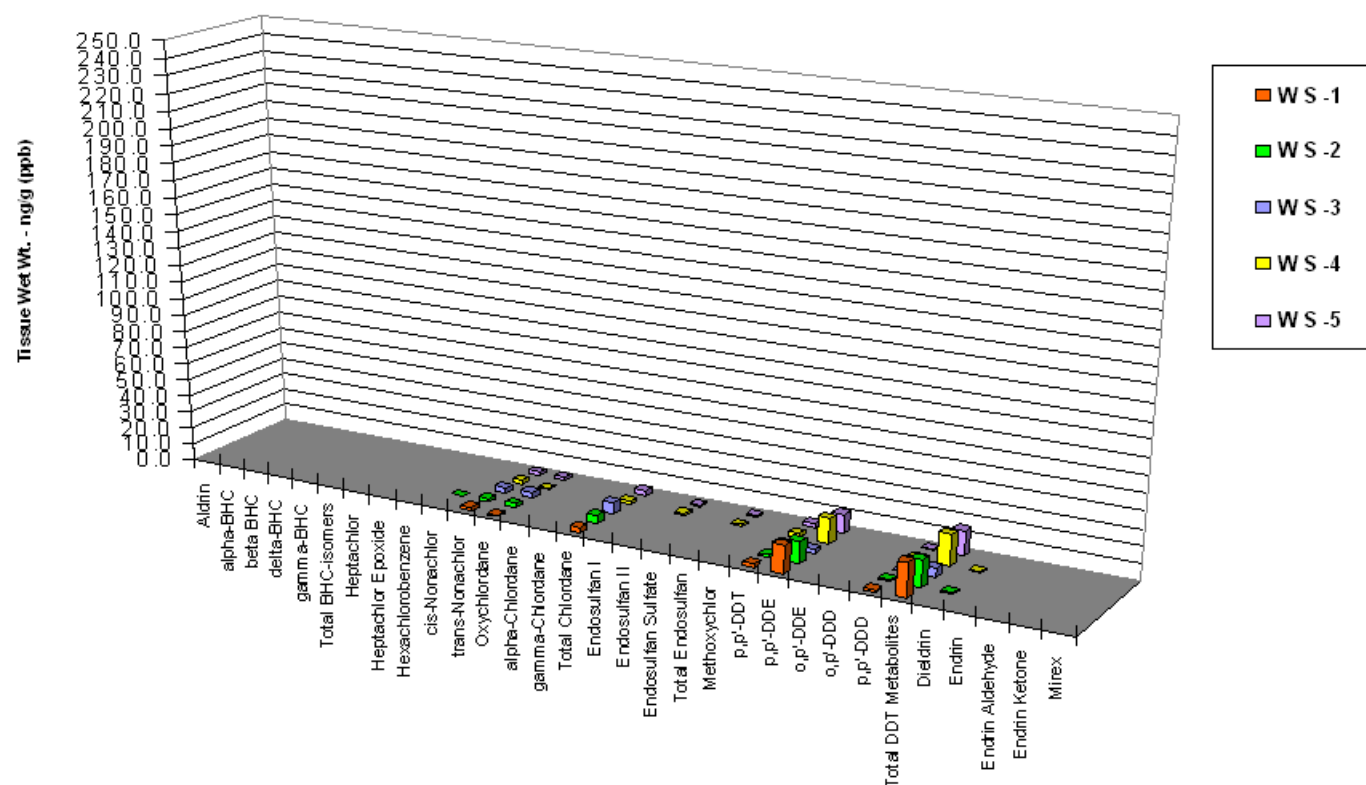
## CT River Reach 5 - Organochlorine Pesticides in Whole White Suckers



**Figure 120.** CT River Reach 5 - Organochlorine Pesticides in Whole White Suckers

One whole WS composites in Reach 5 barely exceeded the cancer SV for subsistence fisher exposure to total chlordane (Figure 120). All whole WS composites exceeded the cancer SV for subsistence fisher exposure to total DDT homologs. All whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

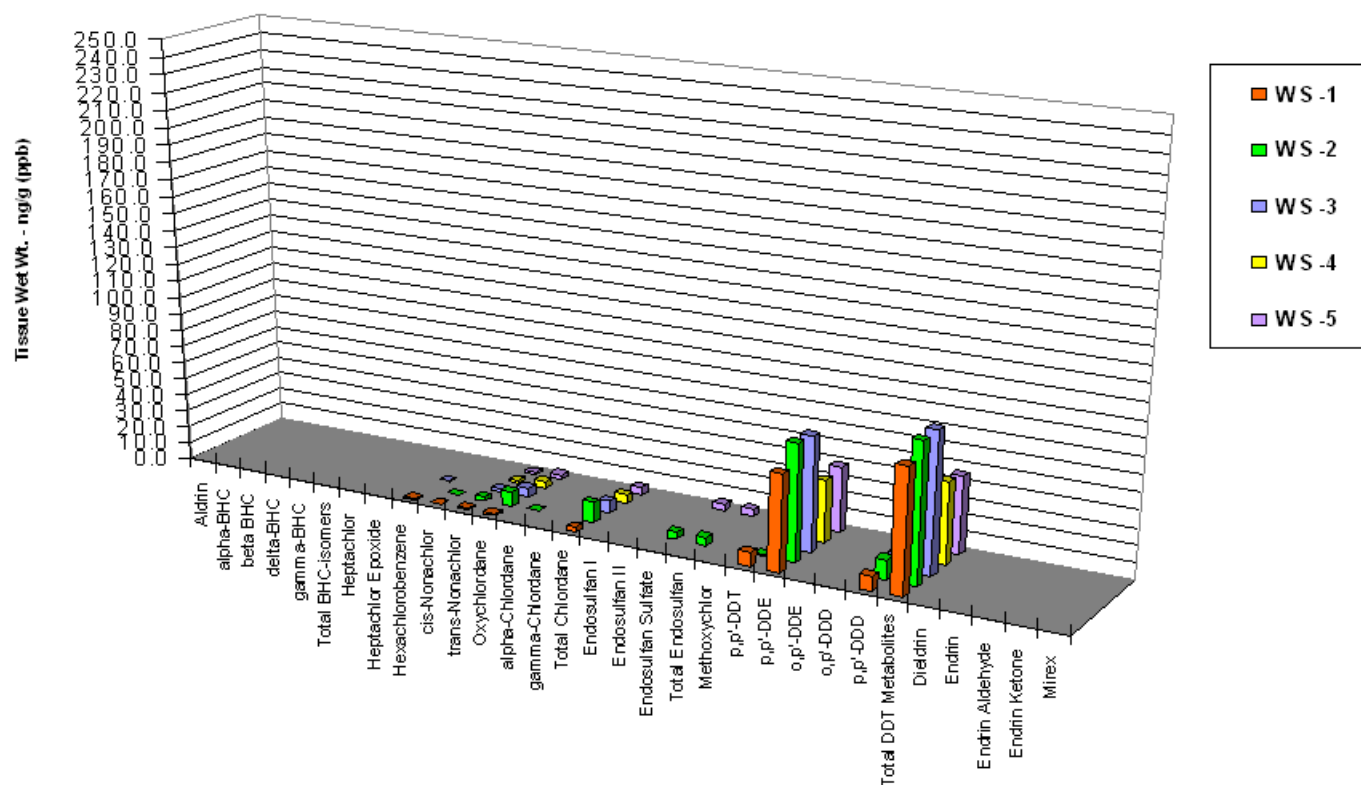
## CT River Reach 6 - Organochlorine Pesticides in Whole White Suckers



**Figure 121.** CT River Reach 6 - Organochlorine Pesticides in Whole White Suckers

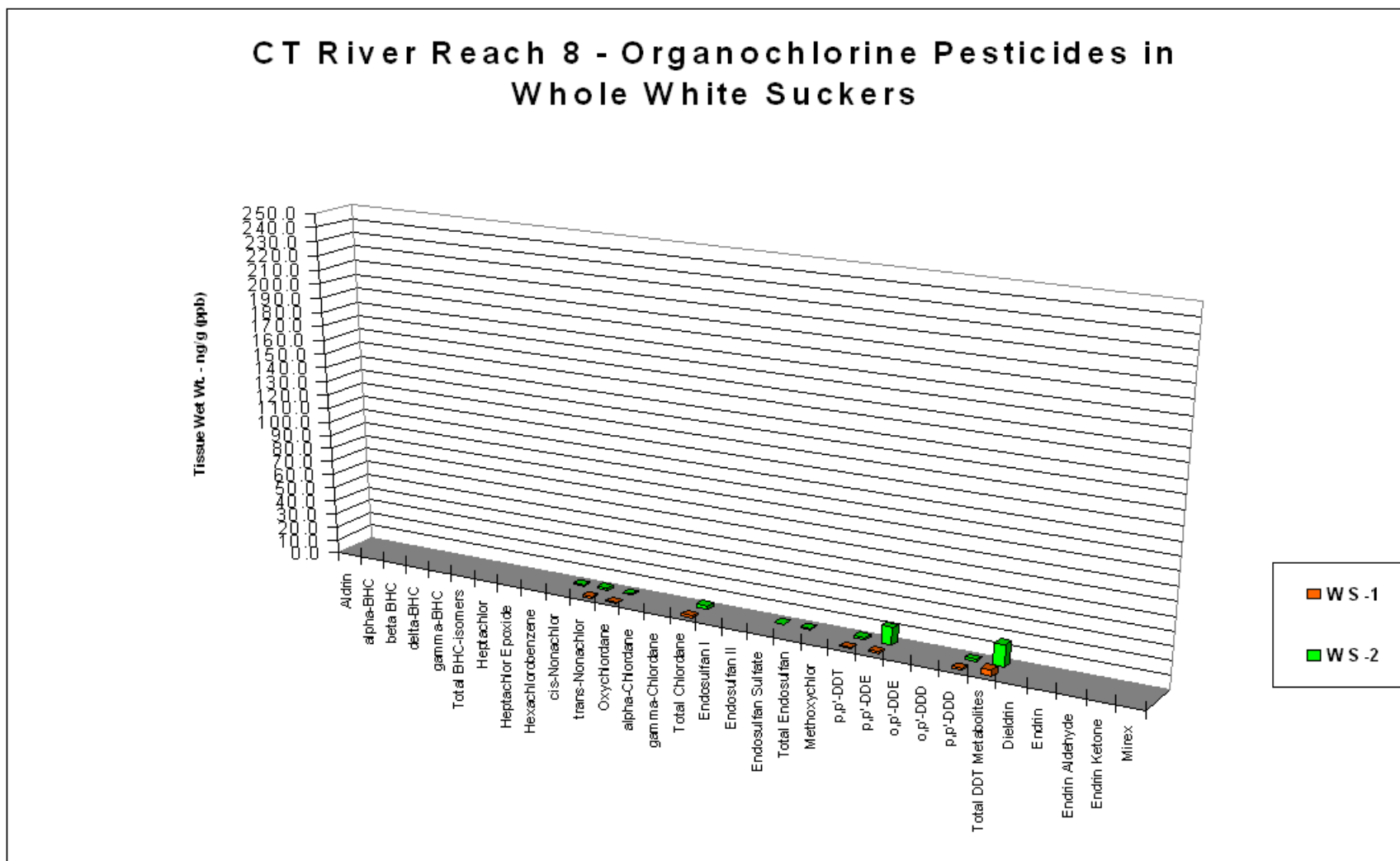
Four whole WS composites in Reach 6 exceeded the cancer SV for subsistence fisher exposure to total DDT homologs (Figure 121). Four whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

## CT River Reach 7 - Organochlorine Pesticides in Whole White Suckers



**Figure 122.** CT River Reach 7 - Organochlorine Pesticides in Whole White Suckers

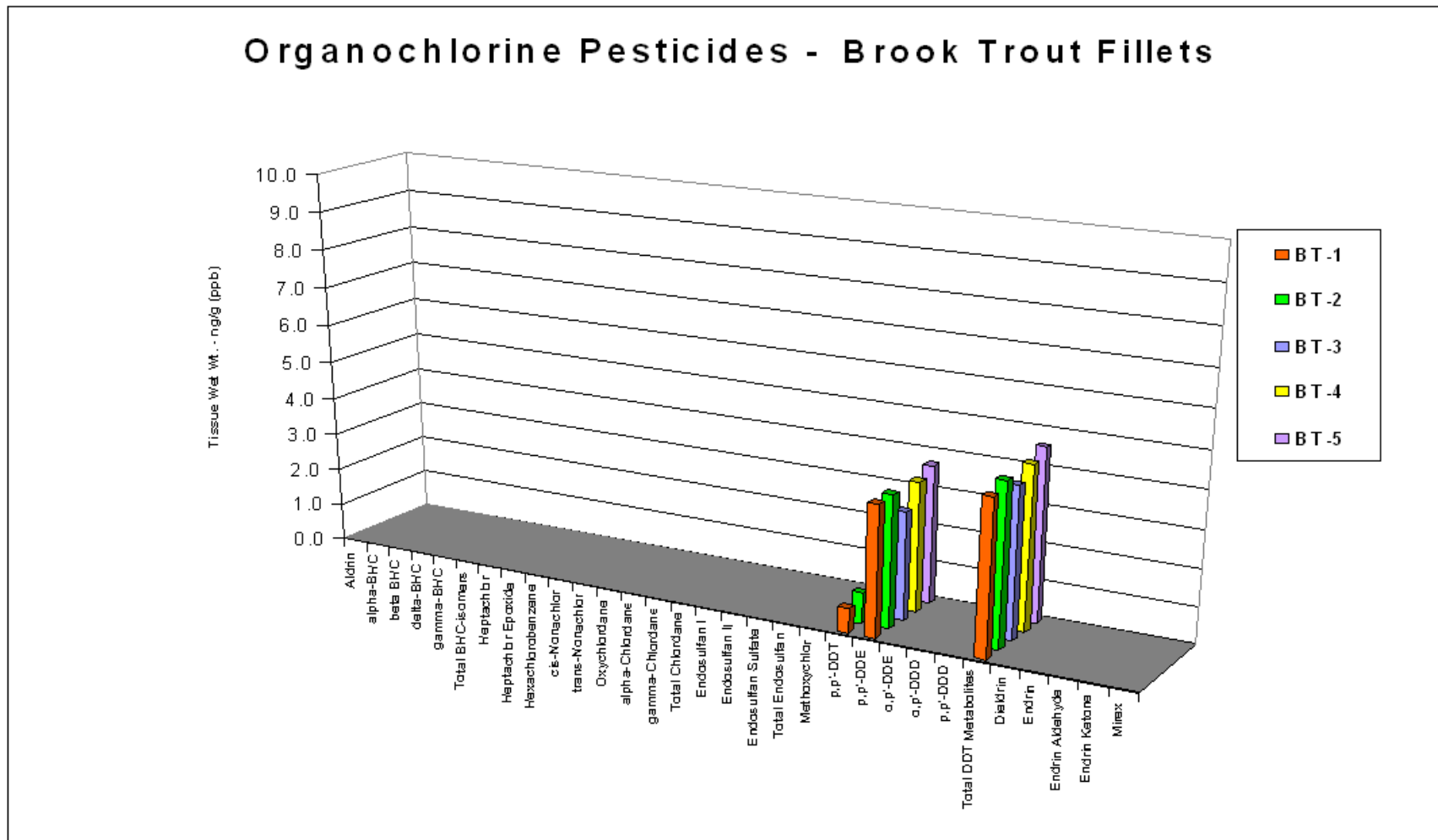
All whole WS composites in Reach 7 exceeded the cancer SV for subsistence fisher exposure to total DDT homologs (Figure 122). All whole WS composites exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.



**Figure 123.** CT River Reach 8 - Organochlorine Pesticides in Whole White Suckers

One whole WS composites in Reach 8 barely exceeded the cancer SV for subsistence fisher exposure to total DDT homologs (Figure 123). One whole WS composite exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

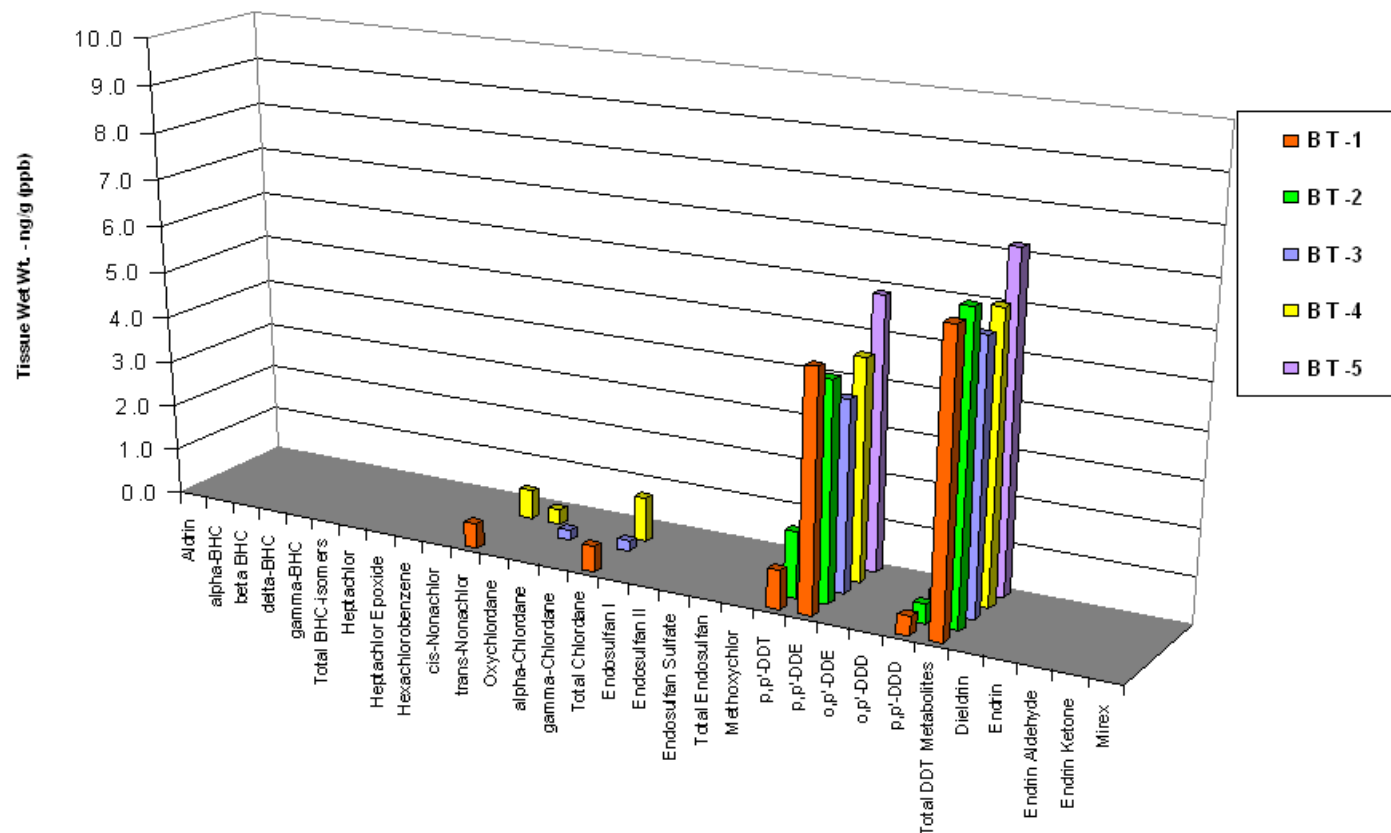
#### 4.2.7 Brook Trout



**Figure 124.** Organochlorine Pesticides in Brook Trout Fillets

No human health SVs were exceeded by brook trout fillet composites (Figure 124). Brook trout, used as reference fish, were obtained from a CTDEP fish hatchery.

## Organochlorine Pesticides - Whole Brook Trout

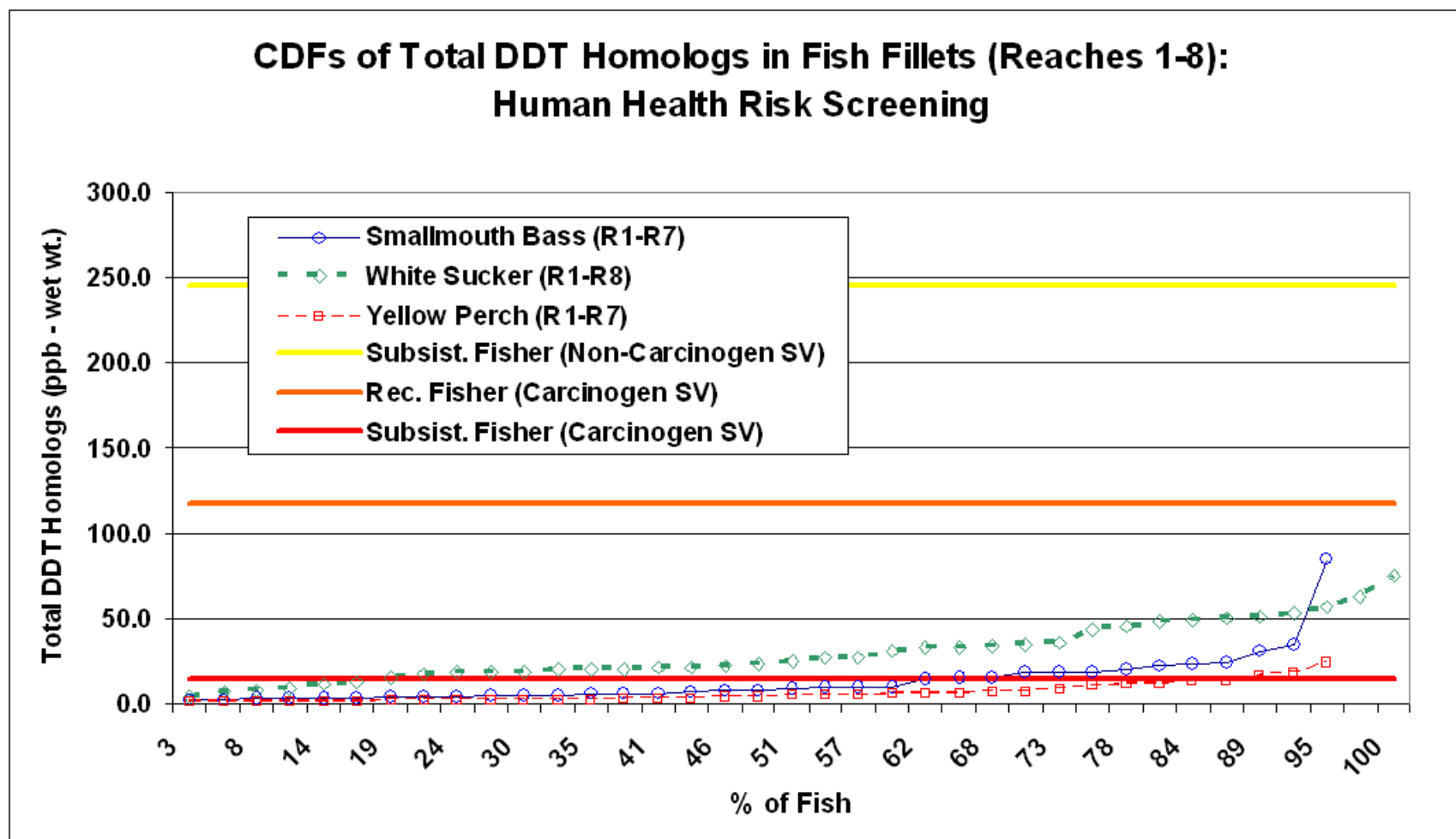


**Figure 125.** Organochlorine Pesticides in Whole Brook Trout

No human health SVs were exceeded by whole brook trout composites (Figure 125). Four whole brook trout composites barely exceeded the NOAEL for belted kingfisher exposure to total DDT homologs.

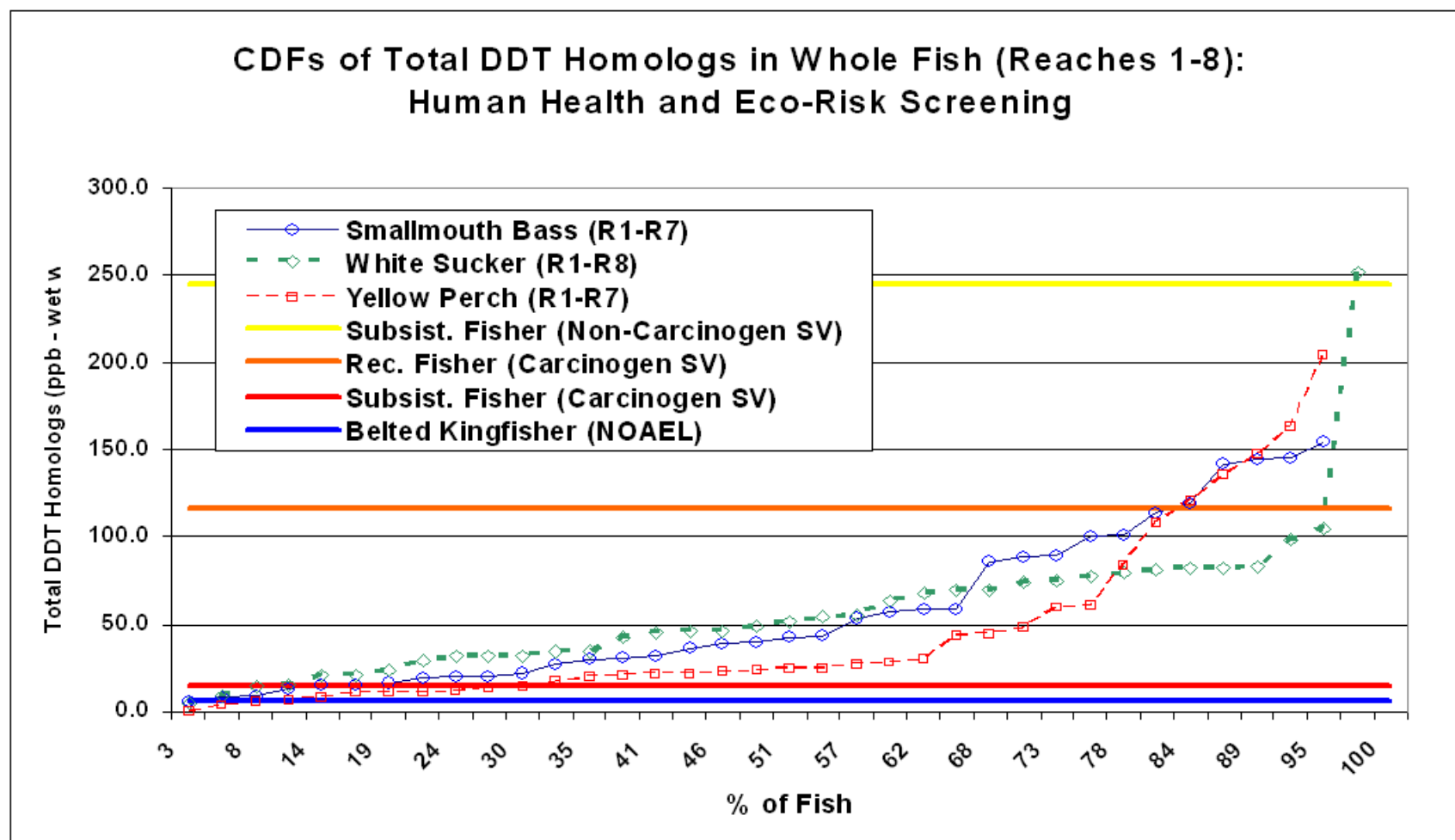
### 4.3 Summary of Total DDT Homolog Human Health and Eco-Risk Screening

No fillet composites of smallmouth bass, yellow perch or white suckers exceeded either the recreational fisher non-cancer or cancer screening values (Figure 126; Tables 45 and 46). Similarly no fillet composites of these species exceeded the subsistence fisher non-cancer screening value. However, 37% of smallmouth bass fillet composites, 9% of yellow perch fillet composites, and 84% of white sucker fillet composites exceeded the subsistence fisher cancer screening value.



**Figure 126.** Cumulative Distribution Functions (CDFs) of Total DDT Homologs in CT River Fish Fillets (Reaches 1-8): Human Health Risk Screening

No whole smallmouth bass or yellow perch composites, and only 3% of whole white sucker composites, exceeded the subsistence fisher non-cancer screening value (Figure 127; Tables 45 and 46). However, 89% of whole smallmouth bass composites, 71% of whole yellow perch composites, and 94% of whole white sucker composites exceeded the subsistence fisher whole fish cancer screening value. No whole fish composites of any of these species exceeded the whole fish river otter eco-risk screening value. However, 97% of whole smallmouth bass composites, 91% of whole yellow perch composites, and 97% of whole white sucker composites exceeded the belted kingfisher eco-risk screening value.



**Figure 127.** Cumulative Distribution Functions of Total DDT Homologs in Whole Fish (Reaches 1-8): Human Health and Eco-Risk Screening

**Table 45.** Number of Filleted and Whole Fish Composites by Species and Reach exceeding Total DDT Homolog Human Health and Eco-Risk Screening Values (n = total # of composites)

Reach	Species	EPA Human Health Risk Screening Values						Eco-Risk Screening Values	
		Recreational Fishers		Subsistence Fishers				River Otter	Belted Kingfisher
		Fillets		Fillets		Whole		Whole (3,250 ppb)	Whole (6 ppb)
		Non-Cancer 2,000 ppb	Cancer 117 ppb	Non-Cancer 245 ppb	Cancer 14.4 ppb	Non-Cancer 245 ppb	Cancer 14.4 ppb		
1 (n=5)	Smallmouth Bass	0	0	0	4	0	4	0	5
	Yellow Perch	0	0	0	0	0	5	0	5
	White Suckers	0	0	0	5	1	5	0	5
2 (n=5)	Smallmouth Bass	0	0	0	4	0	4	0	5
	Yellow Perch	0	0	0	2	0	5	0	5
	White Suckers	0	0	0	4	0	5	0	5
3 (n=5)	Smallmouth Bass	0	0	0	5	0	5	0	5
	Yellow Perch	0	0	0	1	0	5	0	5
	White Suckers	0	0	0	5	0	5	0	5
4	Smallmouth Bass (n=5)	0	0	0	0	0	4	0	4
	Yellow Perch (n=5)	0	0	0	0	0	4	0	4
	White Suckers (n=4 for whole fish)	0	0	0	4	0	4	0	4

Reach	Species	EPA Human Health Risk Screening Values						Eco-Risk Screening Values	
		Recreational Fishers		Subsistence Fishers				River Otter	Belted Kingfisher
		Fillets		Fillets		Whole		Whole (3,250 ppb)	Whole (6 ppb)
		Non-Cancer 2,000 ppb	Cancer 117 ppb	Non-Cancer 245 ppb	Cancer 14.4 ppb	Non-Cancer 245 ppb	Cancer 14.4 ppb		
5 (n=5)	Smallmouth Bass	0	0	0	0	0	4	0	4
	Yellow Perch	0	0	0	0	0	1	0	4
	White Suckers	0	0	0	4	0	5	0	5
6 (n=5)	Smallmouth Bass	0	0	0	0	0	1	0	4
	Yellow Perch	0	0	0	0	0	1	0	4
	White Suckers	0	0	0	4	0	4	0	4
7 (n=5)	Smallmouth Bass	0	0	0	0	0	4	0	5
	Yellow Perch	0	0	0	0	0	4	0	5
	White Suckers	0	0	0	5	0	5	0	5
8 (n=2)	White Suckers	0	0	0	0	0	1	0	1
BT (n=5)	Brook trout	0	0	0	0	0	0	0	4

**Table 46.** Percentage of Fillet and Whole Fish Samples from all Reaches above Total DDT Homolog Human Health and Eco-Risk Screening Values

Species	EPA Human Health Risk Screening Values						Eco-Risk Screening Values	
	% > Recreational Fisher SVs		% > Subsistence Fishers SVs				% > River Otter SV	% > Belted Kingfisher SV
	Fillet		Fillet		Whole Fish		Whole Fish (3,250 ppb)	Whole Fish (6 ppb)
	Non-Cancer 2,000 ppb	Cancer 117 ppb	Non-Cancer 245 ppb	Cancer 14.4 ppb	Non-Cancer 245 ppb	Cancer 14.4 ppb		
Smallmouth Bass	0	0	0	37	0	89	0	97
Yellow Perch	0	0	0	9	0	71	0	91
White Suckers	0	0	0	84	3	94	0	97

In Reach 1 four smallmouth bass fillets, no yellow perch fillets, and all five white sucker fillets exceeded the subsistence fisher cancer screening value for total DDT homologs. Only 1 whole white sucker exceeded the subsistence fisher non-cancer screening value. However, four whole smallmouth bass, five whole yellow perch and five whole white suckers exceeded the subsistence fisher cancer screening value. All five whole fish of the three species exceeded the belted kingfisher eco-risk screening value.

In Reach 2 four smallmouth bass fillets, two yellow perch fillets, and four white sucker fillets exceeded the subsistence fisher cancer screening value. No whole fish of these species exceeded the subsistence fisher non-cancer screening value for whole fish. However, four whole smallmouth bass, five whole yellow perch and five whole white suckers exceeded the subsistence fisher cancer screening value. All five whole fish of the three species exceeded the belted kingfisher eco-risk screening value.

In Reach 3 five smallmouth bass fillets, one yellow perch fillet, and five white sucker fillets exceeded the subsistence fisher cancer screening value. No whole fish of these species exceeded the subsistence fisher non-cancer screening

value for whole fish. However, all five whole fish of all three species exceeded the subsistence fisher cancer screening value. All five whole fish of the three species exceeded the belted kingfisher eco-risk screening value.

In Reach 4 no smallmouth bass or yellow perch fillets and four white sucker fillets exceeded the subsistence fisher cancer screening value. No whole fish of these species exceeded the subsistence fisher non-cancer screening value for whole fish. However, four whole fish of all three species exceeded the subsistence fisher cancer screening value. Four whole fish of the three species exceeded the belted kingfisher eco-risk screening value.

In Reach 5 no smallmouth bass or yellow perch fillets and four white sucker fillets exceeded the subsistence fisher cancer screening value. No whole fish of these species exceeded the subsistence fisher non-cancer screening value for whole fish. However, four whole smallmouth bass, one whole yellow perch, and five whole white suckers exceeded the subsistence fisher cancer screening value. Four whole fish of smallmouth bass and yellow perch and five whole white suckers exceeded the belted kingfisher eco-risk screening value.

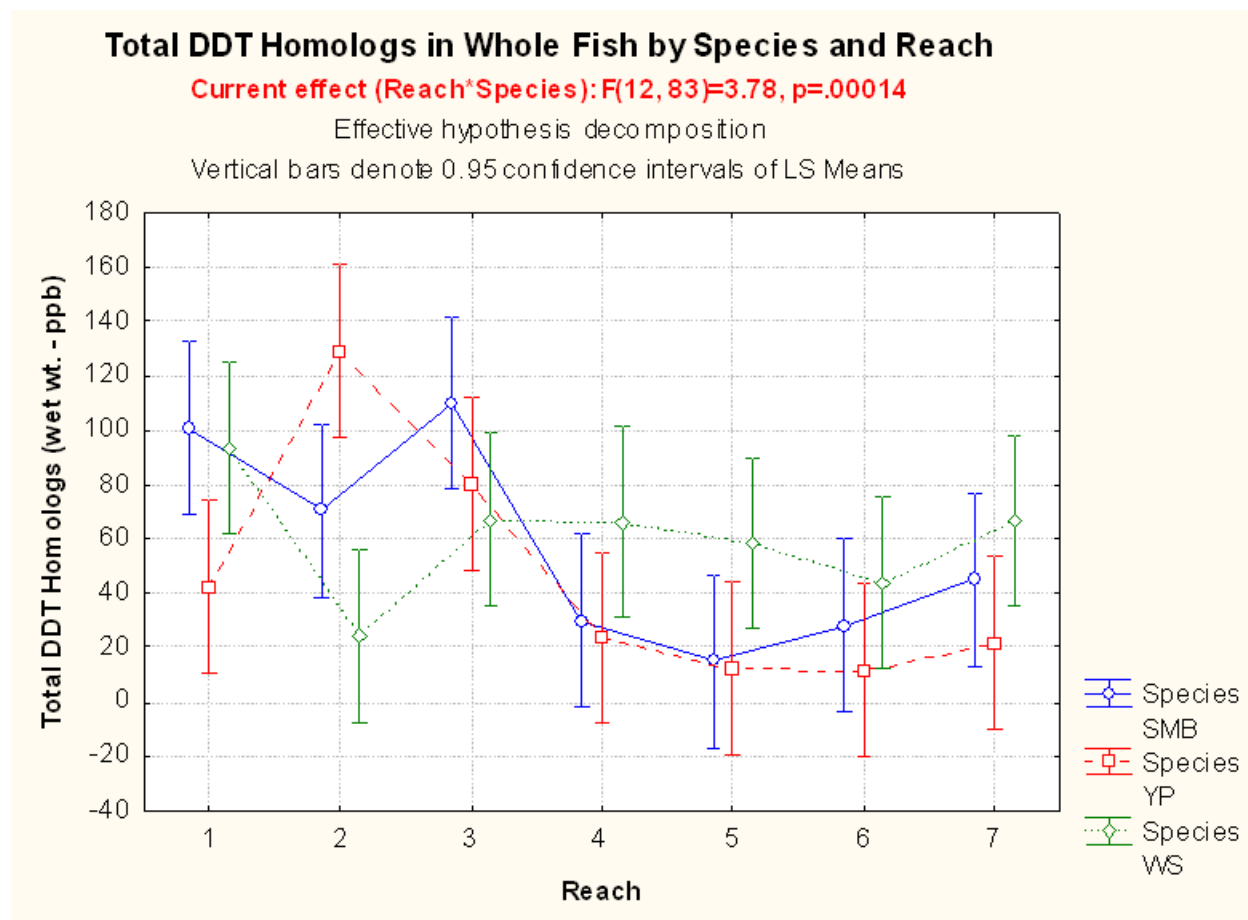
In Reach 6 no smallmouth bass or yellow perch fillets and four white sucker fillets exceeded the subsistence fisher cancer screening value. No whole fish of these species exceeded the subsistence fisher non-cancer screening value for whole fish. However, one whole smallmouth bass and yellow perch and four whole white suckers exceeded the subsistence fisher cancer screening value. Four whole fish of the three species exceeded the belted kingfisher eco-risk screening value.

In Reach 7 no smallmouth bass or yellow perch fillets and all five white sucker fillets exceeded the subsistence fisher cancer screening value. No whole fish of these species exceeded the subsistence fisher non-cancer screening value for whole fish. However, four whole smallmouth bass and yellow perch and all five whole white suckers exceeded the subsistence fisher cancer screening value. All five whole fish of the three species exceeded the belted kingfisher eco-risk screening value.

In Reach 8 no white suckers fillets exceeded any recreational or subsistence fisher human health screening value. Only one whole white sucker exceeded the subsistence fisher cancer screening value. Only one white sucker exceeded the belted kingfisher eco-risk screening value.

## 4.4 Total DDT Homologs - ANOVA by Species and Reach

### 4.4.1 Whole Fish by Species and Reach



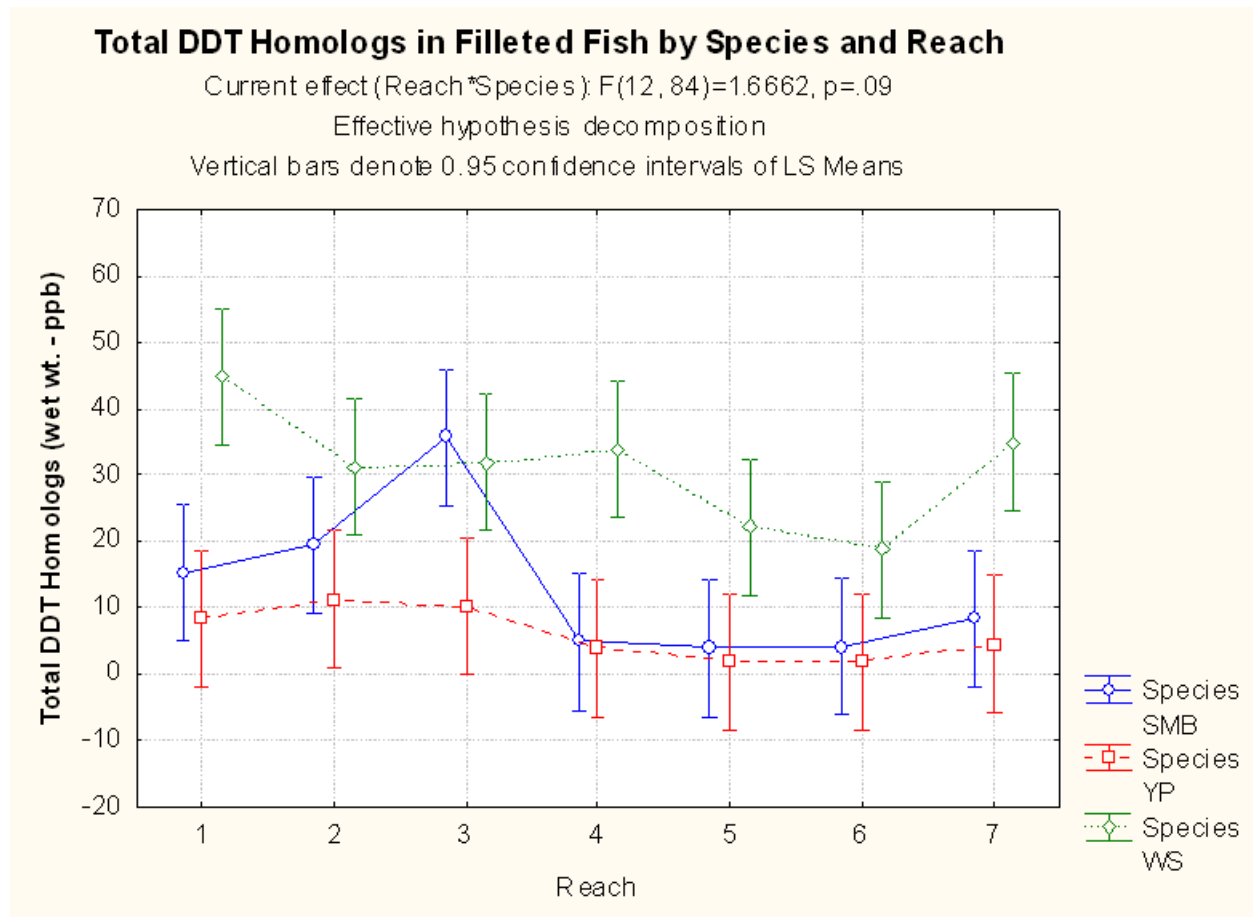
**Figure 128.** Factorial ANOVA of Total DDT Homologs in Whole Fish by Species and Reach

A factorial ANOVA was performed on total DDT homologs in whole fish by species and Reach (Figure 128). A highly significant effect of Species by Reach was observed ( $p=0.00014$ ). Table 47 summarizes the pair-wise comparison of total DDT homologs in whole fish by species and Reach using Fisher's LSD Test.

**Table 47.** Statistical Comparison of Total DDT Homologs in Whole Fish by Species and Reach  
(Fisher's LSD Post-Hoc Test of Least Square Means)

Least Square Means		100.9	42.0	93.3	70.6	128.9	24.4	110.0	80.0	66.9	29.6	23.7	66.3	15.1	12.3	58.5	28.0	11.5	43.6	45.0	21.3	66.7			
Reach		1	1	1	2	2	2	3		3	3	4	4		4	5	5	5	6	6	6	7	7		7
	Spp.	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS			
1	SMB		0.01	0.74	0.18	0.22	1.09E-03	0.69	0.36	0.14	2.25E-03	9.81E-04	0.15	2.80E-04	1.82E-04	0.06	1.79E-03	1.59E-04	0.01	0.02	6.98E-04	0.13			
1	YP			0.03	0.21	2.34E-04	0.44	3.45E-03	0.10	0.27	0.59	0.42	0.31	0.24	0.19	0.47	0.54	0.18	0.94	0.89	0.36	0.28			
1	WS				0.32	0.12	0.00	0.46	0.56	0.25	0.01	2.80E-03	0.26	8.60E-04	5.75E-04	0.13	4.90E-03	5.05E-04	0.03	0.04	2.04E-03	0.24			
2	SMB					0.01	0.04	0.09	0.68	0.87	0.07	0.04	0.86	0.02	0.01	0.59	0.06	0.01	0.24	0.26	0.03	0.86			
2	YP						1.37E-05	0.41	0.03	0.01	3.29E-05	1.21E-05	0.01	2.74E-06	1.67E-06	2.52E-03	2.48E-05	1.43E-06	3.02E-04	3.70E-04	8.04E-06	0.01			
2	WS							2.86E-04	0.02	0.06	0.82	0.97	0.08	0.68	0.60	0.14	0.88	0.57	0.40	0.36	0.89	0.06			
3	SMB								0.19	0.06	6.24E-04	2.56E-04	0.07	6.71E-05	4.27E-05	0.03	4.87E-04	3.70E-05	4.29E-03	0.01	1.78E-04	0.06			
3	YP									0.56	0.03	0.01	0.57	0.01	3.61E-03	0.34	0.02	3.22E-03	0.11	0.12	0.01	0.56			
3	WS										0.10	0.06	0.98	0.02	0.02	0.71	0.09	0.02	0.31	0.34	0.05	0.99			
4	SMB											0.79	0.13	0.52	0.45	0.21	0.94	0.42	0.54	0.50	0.71	0.10			
4	YP												0.08	0.71	0.62	0.13	0.85	0.59	0.38	0.35	0.92	0.06			
4	WS													0.04	0.03	0.75	0.11	0.02	0.35	0.38	0.06	0.99			
5	SMB														0.90	0.06	0.57	0.87	0.21	0.19	0.79	0.03			
5	YP															0.04	0.49	0.97	0.17	0.15	0.69	0.02			
5	WS																0.18	0.04	0.51	0.55	0.10	0.72			
6	SMB																	0.47	0.49	0.45	0.77	0.09			
6	YP																		0.16	0.14	0.66	0.02			
6	WS																			0.95	0.33	0.31			
7	SMB																				0.30	0.34			
7	YP																						0.05		

#### 4.4.2 Filleted Fish by Species and Reach



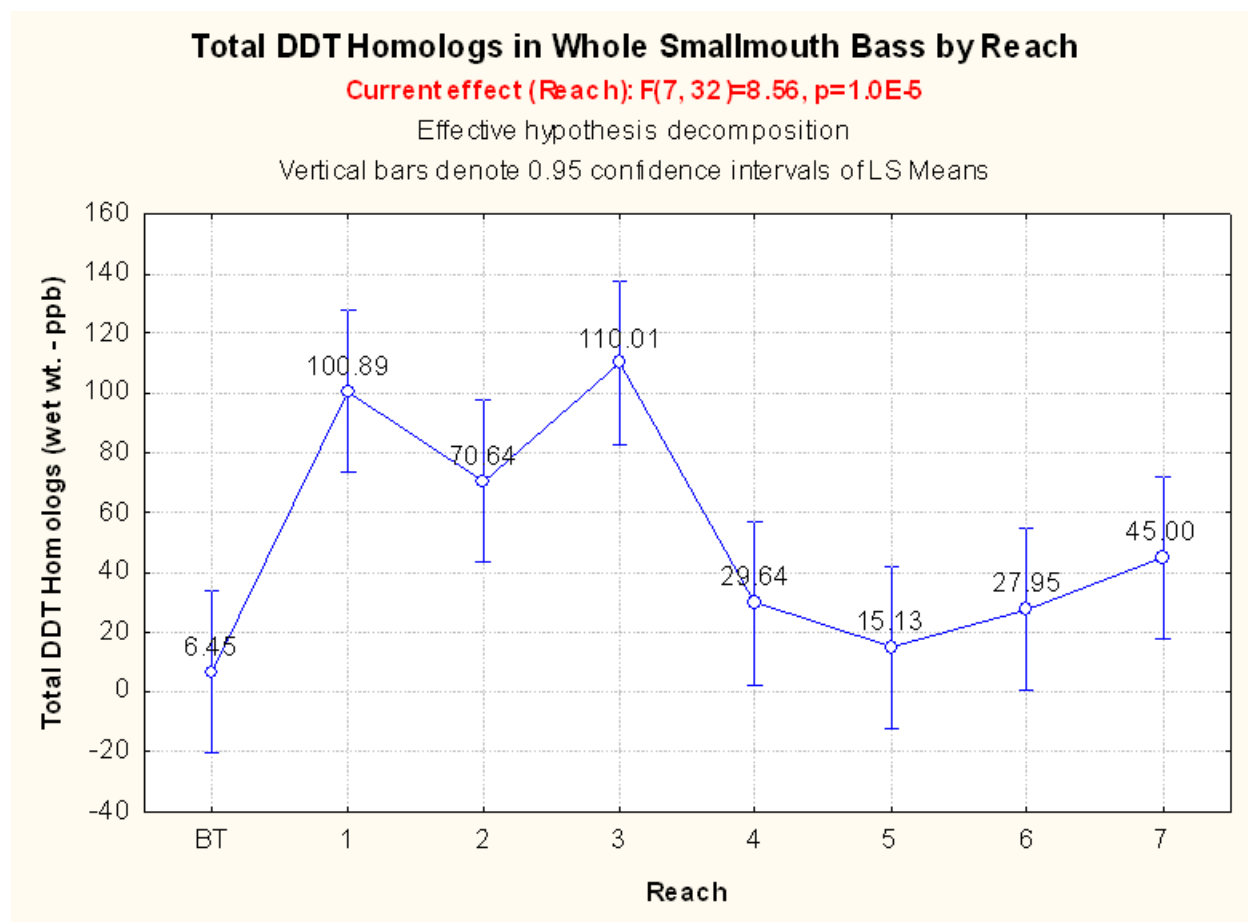
**Figure 129.** Factorial ANOVA of Total DDT Homologs in Filleted Fish by Species and Reach

A factorial ANOVA was performed on total DDT homologs in filleted fish by species and Reach (Figure 129). A non-significant effect of Reach\*Species was observed ( $p=0.09$ ). Table 48 summarizes the pair-wise comparison of total DDT homologs in filleted fish by species and Reach using Fisher's LSD Test.

**Table 48.** Statistical Comparison of Total DDT Homologs in Filleted Fish by Species and Reach  
(Fisher's LSD Post-Hoc Test of Least Square Means)

Least Square Means		15.2	8.4	44.9	19.4	11.3	31.1	35.8	10.3	31.8	4.9	3.9	33.9	3.9	2.0	22.2	4.1	1.8	18.9	8.4	4.4	35.0
Reach		1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7
	Spp	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS	SMB	YP	WS
1	SMB		0.35	1.18E-04	0.57	0.59	0.03	0.01	0.50	0.03	0.16	0.13	0.01	0.12	0.07	0.35	0.13	0.07	0.62	0.35	0.14	0.01
1	YP			3.35E-06	0.13	0.69	2.63E-03	3.36E-04	0.79	1.94E-03	0.64	0.55	7.88E-04	0.54	0.39	0.06	0.56	0.38	0.15	0.99	0.59	4.89E-04
1	WS				8.25E-04	1.61E-05	0.06	0.22	9.42E-06	0.08	4.91E-07	2.85E-07	0.14	2.74E-07	9.07E-08	2.65E-03	3.15E-07	8.47E-08	6.47E-04	3.44E-06	3.65E-07	0.18
2	SMB					0.27	0.12	0.03	0.22	0.09	0.05	0.04	0.05	0.04	0.02	0.71	0.04	0.02	0.94	0.14	0.04	0.04
2	YP						0.01	1.26E-03	0.89	0.01	0.39	0.32	2.78E-03	0.31	0.21	0.14	0.33	0.20	0.30	0.69	0.35	1.78E-03
2	WS							0.52	0.01	0.92	5.87E-04	0.00	0.70	3.68E-04	1.49E-04	0.23	4.12E-04	1.41E-04	0.10	2.68E-03	4.63E-04	0.60
3	SMB								8.05E-04	0.59	6.34E-05	0.00	0.80	3.79E-05	1.41E-05	0.07	4.29E-05	1.33E-05	0.02	3.43E-04	4.88E-05	0.91
3	YP									4.26E-03	0.46	0.39	1.82E-03	0.38	0.26	0.11	0.40	0.25	0.24	0.80	0.42	1.15E-03
3	WS										4.21E-04	0.00	0.78	2.62E-04	1.05E-04	0.19	2.94E-04	9.86E-05	0.08	1.98E-03	3.31E-04	0.67
4	SMB										0.90		1.59E-04	0.89	0.69	0.02	0.92	0.68	0.06	0.63	0.94	9.49E-05
4	YP												9.98E-05	0.99	0.79	0.01	0.98	0.78	0.04	0.54	0.95	5.91E-05
4	WS													9.66E-05	3.72E-05	0.11	1.09E-04	3.50E-05	0.04	8.05E-04	1.23E-04	0.89
5	SMB														0.79	0.01	0.97	0.78	0.04	0.54	0.95	5.72E-05
5	YP															0.01	0.77	0.99	0.02	0.38	0.74	2.16E-05
5	WS																0.02	0.01	0.66	0.06	0.02	0.08
6	SMB																		0.76	0.05	0.56	6.47E-05
6	YP																		0.02	0.37	0.73	2.03E-05
6	WS																			0.16	0.05	0.03
7	SMB																				0.58	5.00E-04
7	YP																					7.33E-05

#### 4.4.3 Smallmouth Bass



**Figure 130.** ANOVA of Total DDT Homologs in Whole Smallmouth Bass by Reach

A one-way ANOVA found a highly significant effect for Reach ( $p=0.00001$ ) in total DDT homologs in whole smallmouth bass (Figure 130). Table 49 summarizes the pair-wise comparison of total DDT homologs in whole smallmouth bass by Reach using Fisher's LSD Test. Reaches 1 and 3 were significantly higher than Reaches 4, 5, 6, and 7. Reach 2 was significantly different than Reaches 3, 4, 5, and 6. Brook trout were significantly less than Reaches 1, 2, 3, and 7.

**Table 49.** Statistical Comparison of Total DDT Homologs in Whole Smallmouth Bass by Reach (Fisher's LSD Post-Hoc Test of Least Square Means)

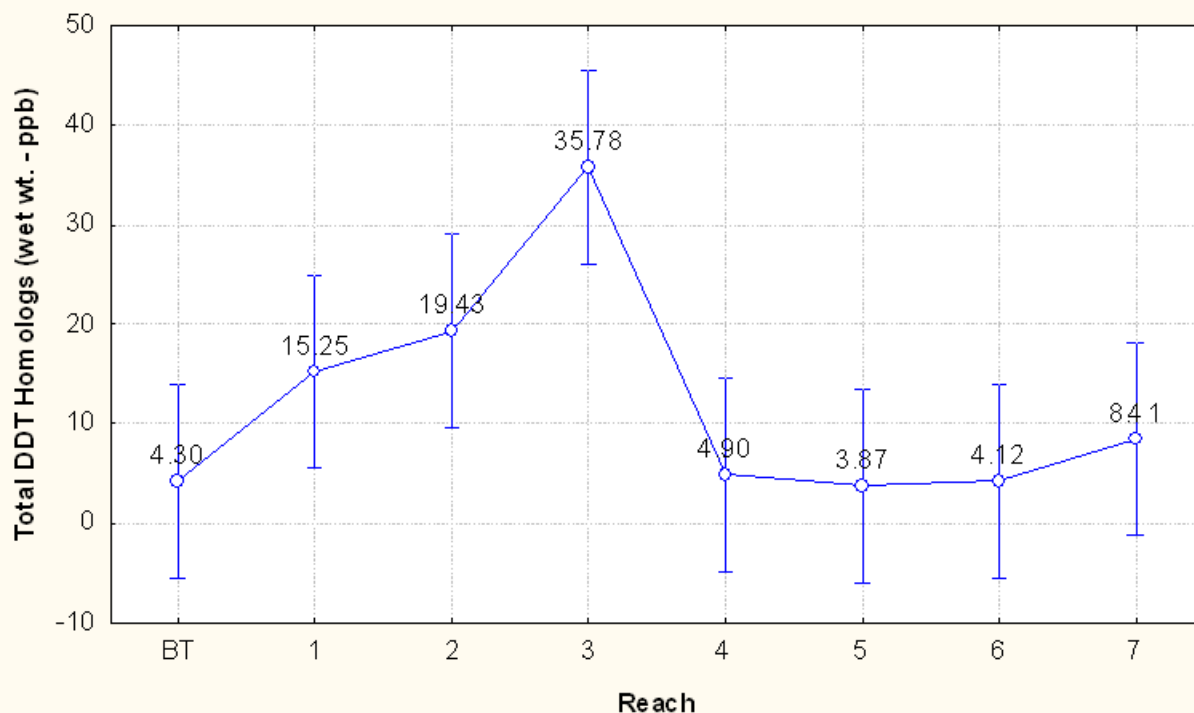
Least Square Means	6.45	100.89	70.64	110.01	29.64	15.13	27.95	45.00
Reach	BT	1	2	3	4	5	6	7
BT		1.93E-05	1.80E-03	4.73E-06	0.23	0.65	0.26	0.05
1			0.12	0.63	6.48E-04	7.33E-05	5.05E-04	0.01
2				0.04	0.04	0.01	0.03	0.18
3					1.66E-04	1.80E-05	1.29E-04	1.60E-03
4						0.45	0.93	0.42
5							0.50	0.12
6								0.37

### Total DDT Homologs in Smallmouth Bass Fillets by Reach

Current effect (Reach):  $F(7, 32)=5.56, p=.0003$

Effective hypothesis decomposition

Vertical bars denote 0.95 confidence intervals of LS Means



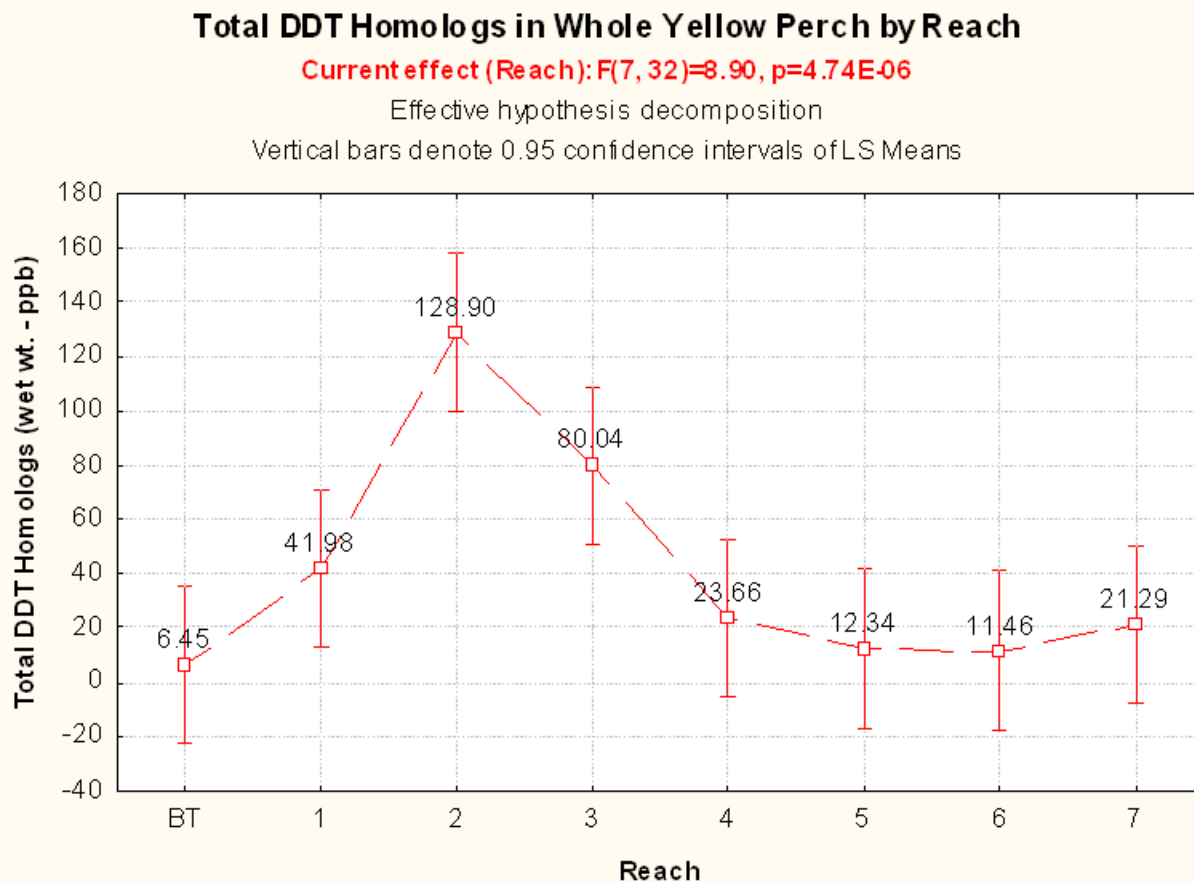
**Figure 131.** Total DDT Homologs in Smallmouth Bass Fillets by Reach

A one-way ANOVA found a highly significant effect for Reach ( $p=0.0003$ ) in total DDT homologs in smallmouth bass fillets (Figure 131). Table 50 summarizes the pair-wise comparison of total DDT homologs in smallmouth bass fillets by Reach using Fisher's LSD Test. Reaches 2 and 3 were significantly different than each other and Reaches 4, 5, 6, 7, and brook trout controls.

**Table 50.** Statistical Comparison of Total DDT Homologs in Smallmouth Bass Fillets by Reach (Fisher's LSD Post-Hoc Test of Least Square Means)

Least Square Means	4.30	15.25	19.43	35.78	4.90	3.87	4.12	8.41
Reach	BT	1	2	3	4	5	6	7
BT		0.11	0.03	5.09E-05	0.93	0.95	0.98	0.55
1			0.54	4.58E-03	0.13	0.10	0.11	0.32
2				0.02	0.04	0.03	0.03	0.11
3					6.58E-05	4.24E-05	4.72E-05	2.91E-04
4						0.88	0.91	0.61
5							0.97	0.51
6								0.53

#### 4.4.4 Yellow Perch

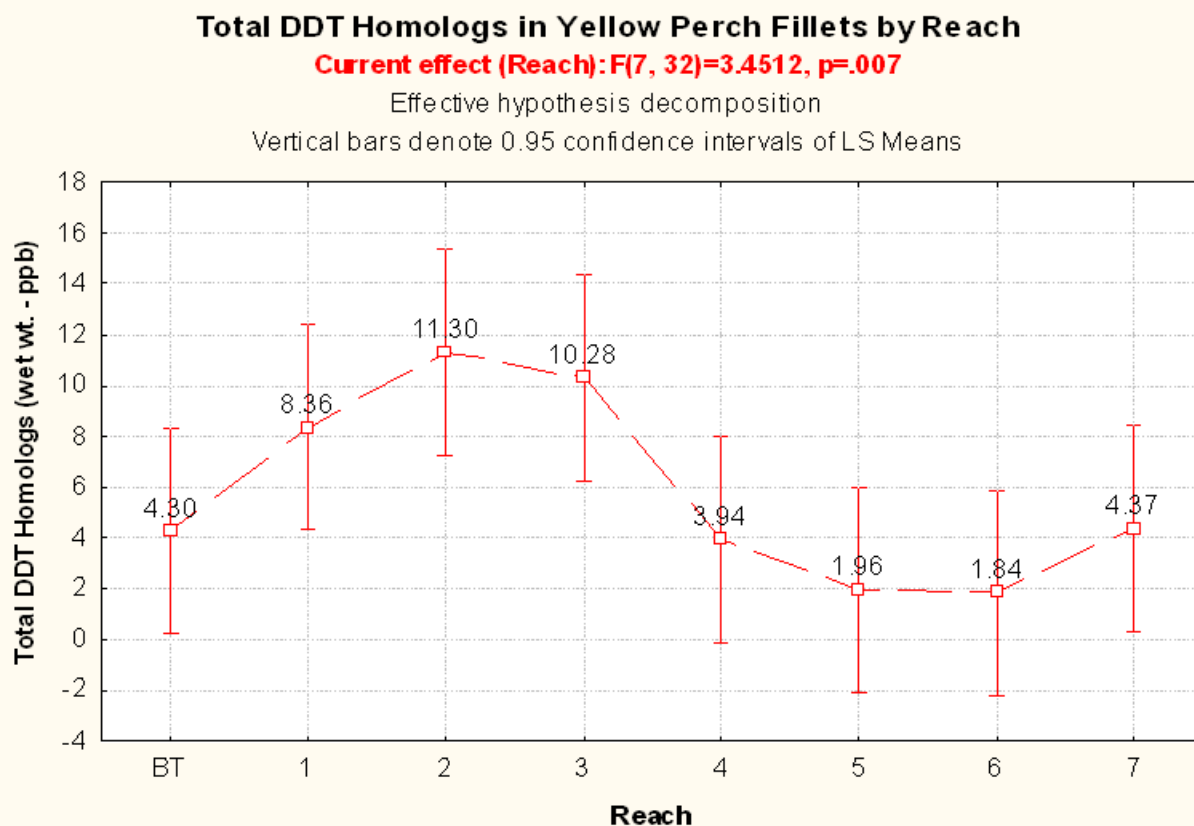


**Figure 132.** ANOVA of Total DDT Homologs in Whole Yellow Perch by Reach

A one-way ANOVA found a highly significant effect for Reach ( $p=4.74E-06$ ) in total DDT homologs in whole yellow perch (Figure 132). Table 51 summarizes the pair-wise comparison of total DDT homologs in whole yellow perch by Reach using Fisher's LSD Test. Reach 2 was significantly higher than all other Reaches and the brook trout controls. Reach 3 was significantly higher than Reach 2, 4, 5, 6, 7, and the brook trout controls.

**Table 51.** Statistical Comparison of Total DDT Homologs in Whole Yellow Perch by Reach (Fisher's LSD Post-Hoc Test of Least Square Means)

Least Square Means	6.45	41.98	128.90	80.04	23.66	12.34	11.47	21.29
Reach	BT	1	2	3	4	5	6	7
BT		0.09	9.88E-07	9.90E-04	0.40	0.77	0.81	0.47
1			1.58E-04	0.07	0.37	0.15	0.14	0.32
2				0.02	1.16E-05	2.29E-06	2.02E-06	8.27E-06
3					0.01	2.17E-03	1.93E-03	0.01
4						0.58	0.55	0.91
5							0.97	0.66
6								0.63



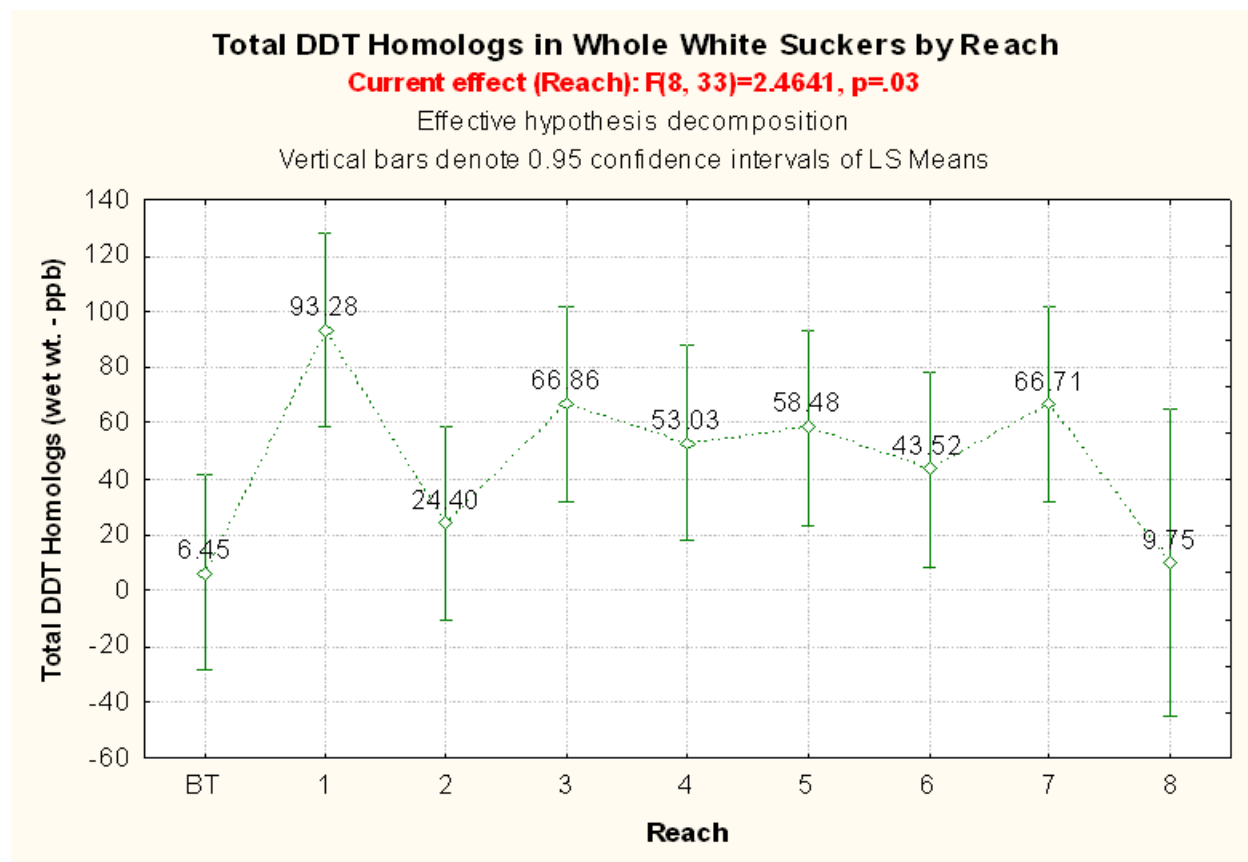
**Figure 133.** Total DDT Homologs in Yellow Perch Fillets by Reach

A one-way ANOVA found a highly significant effect for Reach ( $p=0.007$ ) in total DDT homologs in yellow perch fillets (Figure 133). Table 52 summarizes the pair-wise comparison of total DDT homologs in yellow perch fillets by Reach using Fisher's LSD Test. Reach 1 was significantly higher than Reaches 5 and 6. Reaches 2 and 3 was significantly higher than Reaches 4, 5, 6, 7, and brook trout controls.

**Table 52.** Statistical Comparison of Total DDT Homologs in Yellow Perch Fillets by Reach (Fisher's LSD Post-Hoc Test of Least Square Means)

Least Square Means	4.30	8.36	11.30	10.28	3.94	1.96	1.84	4.37
Reach	BT	1	2	3	4	5	6	7
BT		0.16	0.02	0.04	0.90	0.41	0.39	0.98
1			0.30	0.50	0.13	0.03	0.03	0.17
2				0.72	0.01	2.20E-03	1.97E-03	0.02
3					0.03	0.01	0.01	0.04
4						0.49	0.46	0.88
5							0.97	0.40
6								0.37

#### 4.4.5 White Suckers

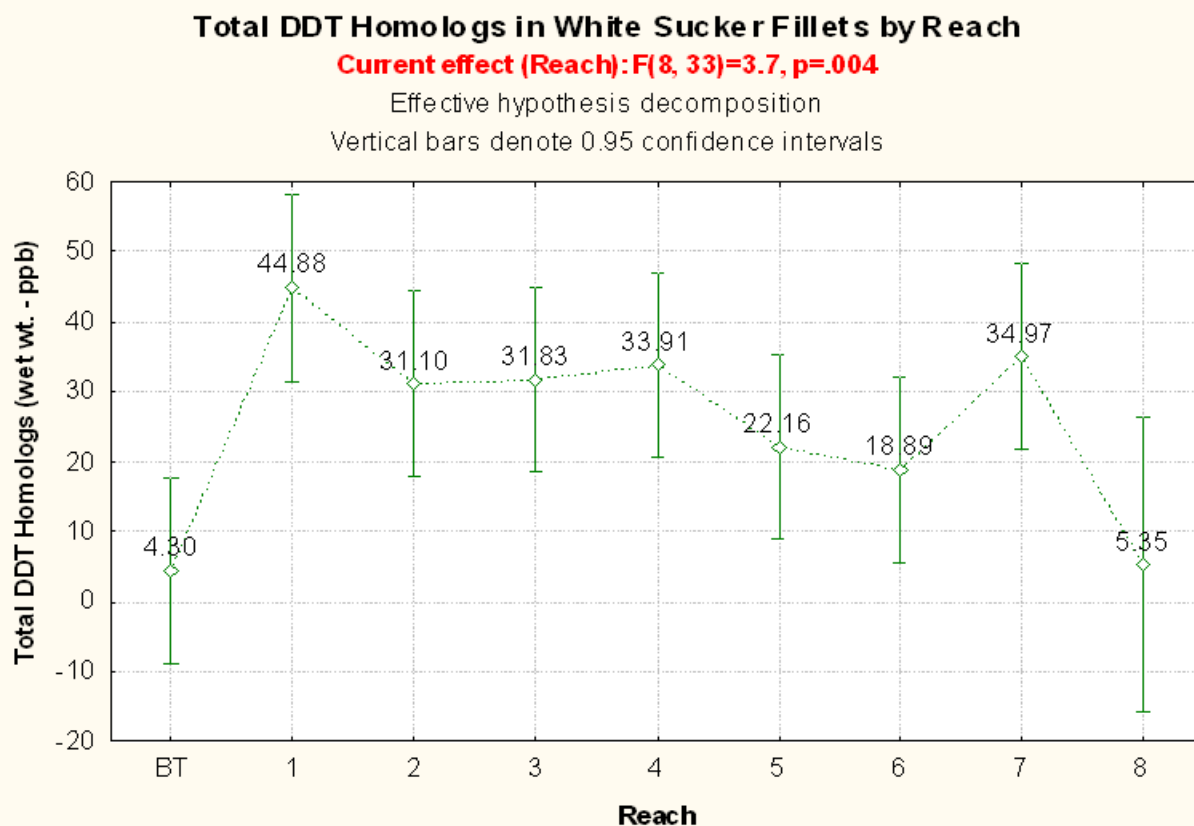


**Figure 134.** Total DDT Homologs in Whole White Suckers by Reach

A one-way ANOVA found a significant effect for Reach ( $p=0.03$ ) in total DDT homologs in whole white suckers (Figure 134). Table 53 summarizes the pair-wise comparison of total DDT homologs in whole white suckers by Reach using Fisher's LSD Test. Brook trout were significantly lower than Reaches 1, 3, 5, and 7. Reach 1 was significantly higher than Reaches 2, 6, and 8.

**Table 53.** Statistical Comparison of Total DDT Homologs in Whole White Suckers by Reach (Fisher's LSD Post-Hoc Test of Least Square Means)

LS Means	6.45	93.28	24.40	66.86	53.03	58.48	43.52	66.71	9.75
Reach	BT	1	2	3	4	5	6	7	8
BT		1.05E-03	0.46	0.02	0.06	0.04	0.13	0.02	0.92
1			0.01	0.28	0.11	0.16	0.05	0.28	0.01
2				0.09	0.24	0.17	0.43	0.09	0.65
3					0.57	0.73	0.34	0.99	0.08
4						0.82	0.70	0.58	0.19
5							0.54	0.74	0.14
6								0.34	0.30
7									0.08



**Figure 135.** Total DDT Homologs in White Sucker Fillets by Reach

A one-way ANOVA found a highly significant effect for Reach ( $p=0.004$ ) in total DDT homologs in white sucker fillets (Figure 135). Table 54 summarizes the pair-wise comparison of total DDT homologs in white sucker fillets by Reach using Fisher's LSD Test. Brook trout was significantly lower than Reaches 1, 2, 3, 4, and 7. Reach 1 was significantly higher than Reaches 5, 6 and 8. Reach 8 was significantly lower than Reaches 1, 2, 3, 4, and 7.

**Table 54.** Statistical Comparison of Total DDT Homologs in White Sucker Fillets by Reach (Fisher's LSD Post-Hoc Test of Least Square Means)

LS Means	4.30	44.88	31.10	31.83	33.91	22.16	18.89	34.97	5.35
Reach	BT	1	2	3	4	5	6	7	8
BT		1.09E-04	0.01	0.01	2.99E-03	0.06	0.12	2.21E-03	0.93
1				0.15	0.17	0.24	0.02	0.01	2.77E-03
2					0.94	0.76	0.34	0.20	0.68
3						0.82	0.30	0.17	0.74
4							0.21	0.11	0.91
5								0.73	0.18
6									0.09
7									0.02

#### **4.4.6 Organochlorine Pesticides - Statistical Summary by Species**

##### **4.4.6.1 Smallmouth Bass**

Total DDT homologs in smallmouth bass fillets in Reach 3 were significantly higher than all other Reaches. Reach 2 was also significantly higher than Reaches 4-6. Total DDT homologs in smallmouth bass fillets in Reaches 2 and 3 were significantly higher than brook trout controls.

Significantly higher levels of organochlorine pesticides were observed in whole smallmouth bass than in fillets. Total DDT homologs in whole smallmouth bass were significantly higher in Reach 1 than in Reaches 4-7. Reach 2 was significantly lower than Reach 3 and higher than Reaches 4-7. Reaches 1, 2, 3, and 7 were significantly higher than brook trout controls.

##### **4.4.5.2 Yellow Perch**

Total DDT homologs in yellow perch fillets were significantly higher in Reach 1 than Reaches 5 and 6. Reach 2 was significantly higher than Reaches 4-7. Reach 3 was also significantly higher than Reaches 4-7. Reaches 2 and 3 were significantly higher than brook trout controls.

Whole yellow perch had significantly higher levels of chlorinated pesticides than yellow perch fillets. Total DDT homologs in whole yellow perch were significantly higher in Reach 2 than all other Reaches. Reach 3 was significantly higher than Reaches 4-7. Reaches 2 and 3 were significantly higher than brook trout controls.

##### **4.4.5.3 White Suckers**

The highest levels of organochlorine pesticides were observed in Reach 1. Total DDT homologs in Reach 1 were significantly higher than Reaches 5, 6 and 8. Reach 8 was significantly lower than Reaches 1, 2, 3, 4, and 7. Brook trout controls were significantly lower than Reaches 1, 2, 3, 4, and 7.

Whole white suckers had significantly higher levels of chlorinated pesticides than yellow perch fillets. Total DDT homologs in whole white suckers were significantly higher in Reach 1 than Reaches 2, 6 and 8. Reaches 3 and 5 were significantly higher than brook trout controls.

## **4.5 Conclusions**

No fillets of smallmouth bass, yellow perch or white suckers exceeded either the recreational fisher non-cancer or cancer screening values (Figure 119; Table 40). Similarly no fillets of these species exceeded the subsistence fisher non-cancer screening value. However, 37% of smallmouth bass fillets, 9% of yellow perch fillets, and 84% of white sucker fillets exceeded the subsistence fisher cancer screening value.

### **4.5.1 Smallmouth Bass**

Total DDT metabolites in smallmouth bass fillets in Reach 3 were significantly higher than all other Reaches. Reach 2 was also significantly higher than Reaches 4-6. Total DDT metabolites in smallmouth bass fillets in Reaches 2 and 3 were significantly higher than brook trout controls.

Five smallmouth bass fillets in Reaches 1-3 exceeded the recreational fisher cancer SV for total chlordane and one fillet barely exceeded the cancer SV for dieldrin. Four smallmouth bass fillets in Reach 1, four in Reach 2, and all five in Reach 3 exceeded the cancer SV for exposure to DDT metabolites. No SMB fillets from Reaches 4-7 exceeded any human health SVs.

Significantly higher levels of organochlorine pesticides were observed in whole smallmouth bass than in fillets. Total DDT metabolites in whole smallmouth bass were significantly higher in Reach 1 than in Reaches 4-7. Reach 2 was significantly lower than Reach 3 and higher than Reaches 4-7. Reaches 1, 2, 3, and 7 were significantly higher than brook trout controls.

Subsistence fisher cancer SVs for DDT metabolites and total chlordane were exceeded in whole SMB in Reaches 1-3. Much lower levels of DDT metabolites and other pesticides were observed in whole SMB in Reaches 4-7. However, subsistence fisher whole fish cancer SVs for DDT metabolites were exceeded in Reaches 4-7.

Four whole smallmouth bass in Reach 1, one in Reach 3 and two in Reach 5 had dieldrin levels exceeding cancer SVs for subsistence fishers.

Whole SMB in Reaches 1-7 exceeded the NOAEL SV for belted kingfisher for exposure to DDT metabolites.

### **4.5.2 Yellow Perch**

Yellow perch fillets had generally low levels of all chlorinated pesticides based on comparisons to screening levels. Total DDT metabolites in yellow perch fillets were significantly higher in Reach 1 than Reaches 5 and 6. Reach 2 was significantly higher than Reaches 4-7. Reach 3 was also significantly higher than Reaches 4-7. Reaches

2 and 3 were significantly higher than brook trout controls.

Whole yellow perch had significantly higher levels of chlorinated pesticides than yellow perch fillets. Total DDT metabolites in whole yellow perch were significantly higher in Reach 2 than all other Reaches. Reach 3 was significantly higher than Reaches 4-7. Reaches 2 and 3 were significantly higher than brook trout controls.

Carcinogenic screening levels for subsistence fishers and in a few cases recreational fishers were exceeded for dieldrin, total chlordane and DDT metabolites. Fillets from Reaches 6 and 7 did not exceed any human health screening thresholds.

For ecological risk screening in whole yellow perch only the low level for belted kingfisher exposure to total DDT metabolites was exceeded in nearly all samples.

#### **4.5.3 White Suckers**

The highest levels of organochlorine pesticides were observed in Reach 1. Total DDT metabolites in Reach 1 were significantly higher than Reaches 5, 6 and 8. Reach 8 was significantly lower than Reaches 1, 2, 3, 4, and 7. Brook trout controls were significantly lower than Reaches 1, 2, 3, 4, and 7.

Subsistence fisher cancer SVs for total chlordane in white sucker fillets were exceeded in Reaches 1 and 2. Cancer SVs for subsistence fishers were exceeded in Reaches 1-8 for exposure to DDT metabolites in white sucker fillets.

Dieldrin levels exceeded the subsistence fisher cancer SV in all WS fillets in Reach 1, in one fillets in Reach 3 and in two fillets in Reach 4.

Whole white suckers had significantly higher levels of chlorinated pesticides than yellow perch fillets. Total DDT metabolites in whole white suckers were significantly higher in Reach 1 than Reaches 2, 6 and 8. Reaches 3 and 5 were significantly higher than brook trout controls.

Only three whole WS in Reach 1 and one in Reach 2 exceeded the subsistence fisher cancer SV for exposure to total chlordane. Nearly all WS fillets in all Reaches exceeded the subsistence fisher cancer SV for exposure to DDT metabolites.

All whole WS in Reach 1 exceeded the subsistence fisher cancer SV for exposure to total chlordane. One WS in Reach 3 and two in Reaches 4 and 5 exceeded the subsistence fisher cancer SV for exposure to total chlordane.

Nearly all whole WS in all Reaches exceeded the subsistence fisher cancer SV for exposure to DDT metabolites.

Three or four whole WS in each of Reaches 1-4 exceeded the subsistence fisher

cancer SV for exposure to dieldrin. Otherwise only two whole WS in Reach 6 had levels of dieldrin that exceeded the subsistence fisher cancer SV.

All whole WS in all Reaches, except for one whole WS in Reaches 6 and 8, exceeded the belted kingfisher NOAEL screening level for exposure to DDT metabolites.

Coles (1998; 1999) found total chlordane in whole white sucker composites at much higher levels than were found in the current study.

#### **4.5.4 Brook Trout**

No human health SV s were exceeded by either hatchery raised brook trout filets or whole brook trout. Four whole brook trout exceeded the NOAEL for belted kingfisher exposure to DDT metabolites.

#### **4.5.5 Summary**

Consumption of organochlorine pesticides in all studied CT river fish, except for hatchery raised brook trout, pose a health risk to subsistence fishers.

Belted kingfisher appears to only be at risk from exposure to DDT metabolites, however, this contamination is extremely persistent and ubiquitous. Otter appear to have no risk posed by CT river wild fish consumption, based on exposure to organochlorine pesticides.